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ABSTRACT

Title: The Effects of Progressive Relaxation and Music on Attention, Relaxation, and Stress Responses: An Investigation of the Cognitive-Behavioral Model of Relaxation.

Author: Peter M. Scheufele, Doctor of Philosophy, 1999

Directed by: Neil E. Grunberg, Ph.D.

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Stress management interventions have been shown to be effective adjuncts for the management of medical disorders, and for the prevention and management of occupational stress. Despite their usefulness, it is not completely understood how behavioral stress management techniques exert their effects. Benson (1975) proposed that all relaxation techniques elicit a general "relaxation response." Davidson and Schwartz (1976) suggested that stress management techniques have specific effects. A compromise position suggests that the specific effects of relaxation techniques are superimposed upon a general relaxation response (Lehrer & Woolfolk, 1993). The cognitive-behavioral model of relaxation suggests that relaxation is achieved through hierarchical cognitive and behavioral factors (Smith, 1988), but has not been adequately evaluated experimentally (Lehrer & Woolfolk, 1993).

The present experiment examined relaxation within a framework of the cognitive-behavioral model. Sixty-seven normal volunteers were exposed to a

stress manipulation and then to one of two relaxation (Progressive Muscle Relaxation, Music) or control conditions (Attention Control, Silence). Measurements of attention, relaxation, and stress responses were obtained during each phase of the experiment. All four groups exhibited similar performance on behavioral measures of attention that suggested a reduction in physiological arousal following their relaxation or control condition, as well as decreased heart rate. Progressive Relaxation resulted in the greatest effects on behavioral and self-report measures of relaxation. The Music condition resulted in the lowest biological measures of stress (i.e., heart rate and cortisol responses).

Results from the present experiment suggest that relaxation techniques involve both attending to a simple stimulus and a reduction in arousal, consistent with previous work. In addition, the results were consistent with the position that specific effects of relaxation techniques are superimposed upon a general relaxation response. Progressive Relaxation protocols may exert their effects by providing cognitive cues to patients to label their reduced arousal as relaxation. Moreover, relaxing music may be useful for the prevention of stress-related symptoms and conditions.

The Effects of Progressive Relaxation and Music on Attention, Relaxation, and Stress Responses: An Investigation of the Cognitive-Behavioral Model of Relaxation

by

Peter M. Scheufele

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INTRODUCTION

It is estimated that at least 20 million Americans have severe, chronic stress-related illnesses, costing at least 75 billion dollars annually in lost productivity and healthcare utilization (Murphy, 1996; Hughes, Pearson, & Reinhart, 1984). Stressors are thought to influence the pathogenesis of physical and mental illnesses by causing negative affective states (such as anxiety and depression) which, in turn, activate biological processes or behavior patterns that influence disease risk (Cohen, Kessler, & Gordon, 1995; Cohen, Evans, Krantz, & Stokols, 1986). The notion that stress could influence the onset and development of physical and psychological disease states has led to the development of stress management interventions that are used within overall disease treatment programs (Lehrer, 1996). Stress management interventions have been shown to be effective adjuncts for the management of somatic disorders, such as hypertension, headaches, and irritable bowel syndrome, as well as behavioral and psychological disorders, such as insomnia, depression, and anxiety disorders (Lehrer, 1996; Lehrer, Carr, Sargunaraj, & Woolfolk, 1994). In addition, stress management programs have been extensively employed in work settings for the prevention and management of occupational stress (Murphy, 1996).

Furthermore, a recent nationwide survey revealed that the use of alternative therapies, including stress management, is highly prevalent in the United States. Specifically, approximately 42% of Americans utilized some form of alternative therapy in 1997, and an estimated 46% of Americans visited an

alternative medicine practitioner, including stress management or relaxation therapists (Eisenberg, Davis, Ettner, Appel, Wikley, Van Rompay, & Kessler, 1998). Moreover, relaxation therapies were used in 11 of the top 14 most frequently reported medical conditions, including back pain, allergies, fatigue, arthritis, headaches, and high blood pressure (Eisenberg et al., 1998). These figures indicate that stress management programs are widely used as alternatives and/or adjuncts to traditional medication therapies. In addition, they serve to indicate the importance of additional research on the basic mechanisms by which relaxation occurs, which are still not fully understood.

Clinically, stress can manifest itself in a variety of ways, ranging from physiologic symptoms to stress-related cognitions to behavioral disturbances. A number of stress management techniques have been developed and used over the past 75 years for the treatment of stress-related conditions. For example, Edmund Jacobson reported “a new method to quiet the nervous system” in an article entitled “Progressive Relaxation” in 1925 (Jacobson, 1925). Other techniques that have been developed and employed for stress management include autogenic training, biofeedback, various Eastern and Western meditation methods, various styles of yoga, as well as more conventional cognitive and behavioral therapies (Lehrer, 1996; Smith, 1988). Over time and with the development of additional interventions, the field of stress management has been able to utilize a combination of these techniques to achieve the most effective treatment possible.

Modern stress management programs typically consist of an education component, a cognitive therapy component, and a behavioral therapy

component that includes learning some type of relaxation skill. However, while stress management techniques have been clearly shown to be effective for the management of stress-related conditions, it is still not fully understood how behavioral stress management techniques exert their effects. Benson (1975) proposed that all relaxation techniques elicit a general "relaxation response." However, an alternative theory by Davidson and Schwartz (1976) suggested that stress management techniques have specific effects. That is, cognitively-oriented methods can be used to target cognitive stress symptoms, whereas autonomically-oriented methods can be used to target autonomic symptoms. More recently, a cognitive-behavioral model of relaxation was advanced by Smith (1988; Smith, Amutio, Anderson, & Aria, 1996), who suggested that relaxation is attained as a result of specific cognitive and behavioral actions. However, this newer, hierarchical model of relaxation has not been adequately evaluated (Lehrer & Woolfolk, 1993).

The present experiment examined the arousal reduction, the specific effects, and the hierarchical models of relaxation. Normal volunteers were exposed to a stress manipulation and then to one of two relaxation or control conditions. Measurements of attention, relaxation, and stress responses were obtained during each phase of the experiment in order to examine the specific cognitive and behavioral components of relaxation proposed by the cognitive-behavioral model of relaxation. The results are discussed in terms of which model most adequately explained relaxation in this sample. Background and support for the experimental design is presented before the experimental protocol. First, the construct of stress is presented. Next, an overview of stress

management is presented and highlights of research on stress management are reviewed. The different explanations for the effects of relaxation are examined, and the rationale for measuring attention is discussed. Aspects of attention and attention measurement that are relevant to the present experiment are reviewed. An overview of the experiment is provided along with specific hypotheses and a detailed methods section. Finally, the results are presented, followed by a discussion of the experimental findings and their relevance to further understanding relaxation.

Stress

Stress is a process that includes three important elements: stressors, stress responses, and factors that may mediate the effects of stress on an organism (Baum, Grunberg, & Singer, 1982; Grunberg & Singer, 1990). Stressors are defined as events (perceived or real) that disrupt the homeostasis of the organism. The disruption of this homeostasis is called the stress response. The stress response is manifested on several levels as defined by the environmental, psychological, and biological traditions that have each contributed to the current biomedical conceptualization of stress (Cohen et al., 1995; Fleming, Baum, & Singer, 1984). From the biological perspective, the stress response includes increased catecholamine and corticosteroid secretion, increased blood pressure, heart rate, and sweating, and constriction of peripheral blood vessels (Baum et al., 1982). From the psychological perspective, the stress response occurs when an event that is perceived as threatening elicits a negative emotional response (Lazarus & Folkman, 1984). Negative emotional responses can vary from self-reported annoyance and

negative mood to changes in health behaviors such as smoking, drinking alcohol, diet, exercise, and sleep patterns, as well as deficits in performance of complex tasks and alterations in interpersonal behavior (Cohen et al., 1986).

The biological, environmental, and psychological approaches examine different aspects of this process in which environmental demands tax or exceed the adaptive capacity of the organism, resulting in psychological and biological changes that may place persons at risk of disease (Cohen et al., 1995; Fleming et al., 1984). The environmental perspective focuses on assessing environmental events associated with the development of stress. The psychological perspective examines the individuals' subjective evaluations of a stressor and their abilities to cope with the demands imposed by a stressor. The biological perspective focuses on bodily systems that are activated by either physically or psychologically demanding situations (Cohen et al., 1995; Fleming et al., 1984). For purposes of the present experiment, the psychological and biological perspectives are most relevant and are presented in more detail.

The biological perspective originated with Walter Cannon's work examining the fight-or-flight response (Cannon, 1914). Cannon proposed that the Sympathetic-Adrenal Medullary (SAM) system reacts to various emergency states by increasing secretion of epinephrine. Other components of this biological response that have since been identified include increased output of epinephrine and norepinephrine, increased heart rate, increased blood pressure, increased sweating, and constriction of peripheral blood vessels (Cohen et al., 1995). These responses have been elicited in response to a wide variety of psychosocial stressors (Levi, 1972).

The biological effects of stressors were further advanced by the work of Hans Selye (e.g., Selye, 1956). Selye reported that physical stressors, such as cold, heat, or physical exercise, elicit a nonspecific physiological reaction involving the Hypothalamic-Pituitary-Adrenocortical (HPA) axis that occurs in response to excessive stimulation. This response, which Selye called the General Adaptation Syndrome (GAS), consists of three sequential stages: Alarm, Resistance, and Exhaustion. The initial Alarm stage of this process involves physiological changes in the organism necessary to meet the demands required by the stressor. In this stage the anterior pituitary gland secretes adrenocorticotrophic hormone (ACTH), which activates the adrenal cortex to secrete additional stress hormones, such as cortisol in humans. This process occurs rapidly in response to a stressor. In the Resistance stage, the organism attempts to adapt to the stressor and the output of corticosteroids remains high but stabilizes. If the stressor is sufficiently severe or prolonged, or adaptation to the stressor is not achieved, then the organism's body enters a state of exhaustion in which there is depletion of the body's reserves. For example, the anterior pituitary and the adrenal cortex lose their capacity to secrete hormones, and vulnerable organs break down if the stressor continues unabated.

Selye asserted that any noxious agent, physical or psychosocial, would mobilize the GAS response. However, Mason (1975a, 1975b) reported that different stressors resulted in different endocrinological profiles, challenging the idea that the stress response is general and identical across stressors. In addition, Mason (1975b) suggested that psychological factors such as predictability, controllability, and perceived control may modify the stress

response. Although hormones of the SAM and HPA axis are most often discussed as the biochemical substances involved in stress responses, a host of other hormones, neurotransmitters, and brain substances have been reported to be modified by the stress response, including growth hormone and prolactin secreted by the pituitary gland, and the endogenous opioid peptides released in the brain (Baum, et al., 1982; Cohen et al., 1995).

The psychological stress approach emphasizes the organism's perception and evaluation of the potential harm posed by environmental events (Cohen et al., 1995; Lazarus & Folkman, 1984). When the demands imposed by an environmental event exceed an individual's abilities to cope, individuals label themselves as stressed and experience a negative emotional response. Psychological models of stress argue that events influence only those people who perceive and interpret them as stressful, and this perception of stress is based upon both the interpretation of the event and the evaluation of coping resources. One model illustrating this process was proposed by Lazarus (1966), who described the interpretation of the event as "primary appraisal," and the evaluation of coping responses as "secondary appraisal." Primary appraisal is a process between stimulus presentation and stress reaction by which an individual will experience a stress reaction if the event is evaluated as a harm/loss, threat, or challenge (Lazarus, 1977). Factors involved in this stage of evaluation include magnitude or intensity of the stimulus, duration of the stimulus, and controllability of the stimulus, as well as an individual's beliefs about themselves and their environment, and the strength of their values and commitment. Secondary appraisal requires individuals to evaluate their

resources in order to determine whether they can cope with a situation by eliminating or at least lessening the effects of the stressful stimulus. Coping refers to the person's cognitive and behavioral efforts to manage (reduce, minimize, master, or tolerate) the internal and external demands of the person-environment transaction that is appraised as exceeding current resources. Coping is thought to have two major functions: dealing with the problem that is causing the distress (problem-focused coping) and regulating emotion (emotion-focused coping) (Folkman, Lazarus, Gruen, & DeLongis, 1986). Emotion-focused coping may be somatically oriented, such as using tranquilizers, or intrapsychic responses such as denial of danger. If an individual perceives that they have effective coping resources available, then the threat is minimized, and no stress response occurs. Alternatively, if an individual is uncertain if he or she is capable of coping with a situation that has been appraised as threatening, then stress is experienced (Lazarus & Folkman, 1984).

Self-reported negative emotional responses and changes in behavioral performance that can each be measured in a laboratory setting are useful, face-valid indicators that an individual may be experiencing stress in response to a laboratory challenge. In addition, measures of increased heart rate, increased blood pressure, and increased corticosteroid secretion provide corroborating evidence that an individual is experiencing a stress response. Because the stress response occurs on several levels, investigators have argued that a multi-level assessment of stress is optimum in laboratory settings to validate that an individual's response to laboratory stressors (Baum et al., 1982; Grunberg & Singer, 1990; Baum & Grunberg, 1995). Specifically, multilevel assessments

may include not only self-report measures of mood and stress, but also may include behavioral measures of smoking, eating, and drug-taking; performance measures on cognitive tasks; physiological measures to track changes in heart rate and blood pressure; and biochemical measures to index changes in hormone responses to stressors. Together, these measures can provide a more accurate picture of an individual's stress response than they can report, and the accurate understanding of the multilevel nature of stress helps researchers to understand and develop more accurate hypotheses of phenomena that they observe in the natural environment. Having briefly examined the stress construct, the next section presents an overview of stress management relevant to present experiment.

Stress Management: Clinical Overview

Because stress pervades virtually every aspect of life to some extent and is strongly related to numerous diseases, the assessment and management of stress is an important step that should be taken by health-care providers to incorporate into treatment planning (Hughes et al., 1984). The importance of assessing the effects of stress as part of a comprehensive medical or mental health evaluation is further reflected by the inclusion of a stress-related axis [Axis IV] as part of the psychiatric multi-axial diagnostic nomenclature in use today (DSM-IV, 1994). As part of using the DSM-IV multi-axial diagnostic system, clinicians are directed to use Axis IV "for reporting psychosocial and environmental problems that may affect the diagnosis, treatment, and prognosis of mental disorders" (DSM-IV, 1994, p. 29). However, to effectively deliver treatment for the effects of stress, the clinician needs to assess for more than

the mere problems or events that are required to be reported by the DSM.

Assessing stress begins with identifying stress-related symptoms when patients present with them. Stress symptoms seen clinically can include disrupted body systems, hyper-emotionality, altered cognitive function, and psychomotor disturbances. Some common clinical symptoms of stress may include: *systemic*, ranging from flushing and sweating to angina, tachycardia, headache, backache, fatigue, insomnia, and gastrointestinal upset; *emotional*, ranging from agitation, anxiety, and panic to depression, irritability, and emotional fatigue; *cognitive*, such as worries, distractibility, memory problems and attention deficits; and *psychomotor*, such as tremor, spasm, sighing, lack of coordination, muscular tension, and startle sensitivity (Hughes et al., 1984).

The symptoms listed above represent a range of severity that stress-related conditions may develop into by the time an individual seeks professional medical attention for a condition. However, stress-related negative affect and illness may develop as a result of reactions that people have to daily events and stimuli in the world around them (Hughes et al., 1984). Health care providers who identify stress symptoms when patients first present with them can develop treatment plans to help patients develop skills to cope more effectively with stressors. Using a stress-management intervention to augment conventional treatments can prevent the development of more severe stress-related physical and/or psychological disorders.

The first step of a stress management intervention typically requires the patient to identify stress-related events and stimuli, using ongoing and retrospective methods for identifying stressors. A stress diary is useful for

patients to record symptoms and internal and external events for ongoing stressor identification, whereas retrospective identification relies on the patient's memory to record situations that produce stress. Although memories of stressful events can be plagued with lapses, retrospection may be useful for identifying common patterns of stressful events or stimuli, such as persons, places, or things that initiate stress symptoms, as well as the patient's cognitive and emotional reactions to these stimuli. Retrospective information can then be corroborated with ongoing stressor identification (Hughes et al., 1984).

Once stress symptoms and stressors have been identified, the second step of a stress management intervention is to develop a plan to deal with the identified symptoms and triggers of stress (Tolman & Rose, 1985; Hughes et al., 1984). This step typically incorporates three components: (1) a relaxation or behavioral component, used to reduce physiological arousal caused by stress; (2) a cognitive therapy component, to address negative self-talk that may result in faulty stress appraisals; and (3) an educational or skills training component designed to boost the patient's skills in an area identified as central to the patient's difficulties coping with stress, such as assertiveness training, social skills training, or time management training. Programs using these components have been used to provide exceptional benefits in conjunction with regular therapy. The results of numerous studies show that both physical and mental benefits are received by participants of group or individual stress management programs, with a combination of relaxation and cognitive-behavioral therapy having the most beneficial effects (e.g., Murphy, 1996; Lehrer et al., 1994). The next section presents key points derived from the stress management literature.

Stress Management: Key Points

Stress management techniques are currently employed in a wide variety of medical settings as part of treatment programs for numerous physical and psychological conditions, as well as in occupational settings for the prevention and management of occupational stress. The purpose of this section is not to review the entire literature on these treatments, which is beyond the scope of the present work. Rather, the purpose of this section is to highlight key points that have emerged from research on the use of stress management interventions. Comprehensive reviews of the effectiveness of stress management for the treatment of medical conditions (Lehrer & Woolfolk, 1993), and for the treatment of occupational stress (Murphy, 1996) are available.

Research on the effectiveness of stress management interventions for medical conditions generally suggests that, overall, this form of treatment is more effective than placebo treatments, is at least equivalent to other behavioral interventions (such as exercise or dietary treatments), but is less effective than drug therapies (Lehrer, 1996; Lehrer & Woolfolk, 1993). Stress management may be most effective when applied as a preventative intervention strategy with patients reporting mild to moderate levels of a stress-related condition. For example, reviews of stress management interventions for the treatment of hypertension conclude that these methods can be effective for patients with mild to moderate hypertension, allowing them to reduce their dosages of antihypertensive medications (e.g., Lehrer et al., 1994; Blanchard, McCoy, Musso, Gerardi, Pallmeyer, Gerardi, Cotch, Siracusa, & Andrasik, 1986; Glasgow, Gardner, & Engel, 1982). Therefore, including stress management

interventions as adjuncts to medication therapies may provide long term cost-benefits by reducing medication costs, reducing medical utilization, and even reducing the prevalence of severe cases of some stress-related disorders.

Stress management interventions may provide additional benefits to patients that are not provided by traditional medication treatments. That is, self-regulatory treatments may result in a number of psychological "side effects" that are beneficial to the patient (Blanchard, Radnitz, Schwartz, Neff, & Gerardi, 1987). For example, Blanchard and colleagues (1987) reported that a stress management intervention for patients with irritable bowel syndrome (IBS) also resulted in significant reductions in depression and anxiety among patients who also reported reduced symptoms of IBS. In addition to improving mood and reducing physical distress, stress management interventions may also result in improvements in behavioral functioning. For example, stress management interventions for hypertension may not only help to reduce blood pressure levels, but may also help reduce individual risk factors for coronary heart disease, such as reducing Type A behaviors (Bennett & Carroll, 1990).

These reports indicate that psychological interventions are useful adjuncts to medication treatments, and may even be preferable in some cases where medication results in deleterious side effects, where extended medication use may result in drug dependence, where the cost of medication for chronic treatment may be prohibitively expensive, or where a patient may be able to learn new psychological coping skills from stress management treatments that would not be learned from using medication alone (Lehrer & Woolfolk, 1993). That is, combining stress management interventions with medication treatment

may help some patients to develop more effective methods for coping with stress than they previously had available. As patients learn to cope more effectively with stressors, they may develop a greater sense of control over their reactions to stress (Baum, Gatchel, & Krantz, 1997). These improvements may result in an increased sense of self-efficacy, that may in turn lead to further reductions in other stress-related health-risk behaviors, such as decreasing or quitting smoking, or resuming an exercise program (Brantley & Thomason, 1995).

One potential drawback of stress management interventions is the patient's compliance with this form of intervention. In fact, high dropout rates in one study led the researchers to suggest that more research is needed on patient compliance with self-regulatory treatments (Lehrer, Hochron, Mayne, Isenberg, Carlson, Lasoski, Gilchrist, Morales, & Rausch, 1994). Although regular practice seems to help patients learn the details of a relaxation method at the beginning of a treatment, regular practice does not appear to be necessary to maintain long-term treatment gains (Lehrer, 1996). That is, occasional or even symptomatic practice of stress management techniques appears to be as effective over the long term as a regular regimen. However, patients who stop practicing their techniques altogether tend to show a reoccurrence of symptoms (Lehrer & Woolfolk, 1993). These findings suggest that stress management techniques may have a central mechanism that, if identified, could be useful in a number of treatment applications.

In clinical stress management programs, relaxation is thought to be one of the most potent anti-stress strategies (Lehrer et al., 1994; Hughes et al., 1984). In these clinical settings, relaxation does not refer to a brief time-out from

identified stressors. Rather, it traditionally refers to the development of an important stress management skill, specifically, learning to reduce physiologic arousal (Smith, 1988; Hughes et al., 1984). A number of techniques have been developed to teach patients how to initiate physiologic relaxation, including progressive muscle relaxation, biofeedback, autogenic training, and various meditation methods. Each of these techniques has some empirical evidence to support use as a clinical stress management technique (Lehrer, 1996; Lehrer et al., 1994). The next two sections review information about two stress management techniques relevant to the present experiment.

Progressive Relaxation

In a paper entitled "Progressive Relaxation," published in 1925, Edmund Jacobson reported the procedure for and effects of "a new method to bring quiet to the nervous system" (Jacobson, 1925, p. 73). Using this procedure, a patient tensed muscles or muscle groups, one at a time, in order to learn to recognize the sensations associated with tension in particular muscles. The patient then relaxed the muscle tension and was instructed to recognize the contrast between tension and relaxation. Using a technique Jacobson called "the method of diminishing tensions," the patient made smaller and smaller muscle contractions until the muscle was tensed almost at the level of sensory threshold. In a typical case, a patient attended 20 or more sessions of instruction to distinguish minute levels of muscle "tenseness" in approximately 44 muscle groups, and to eliminate them completely (Jacobson, 1938; Lehrer, 1982; McGuigan, 1993).

Revisions subsequently have been made to Jacobson's original technique (e.g., Bernstein & Berkovec, 1973). These revised methods have the patient

continue to tense and relax groups of muscles throughout treatment, and emphasize paying attention to the contrasting tension and relaxation of a condensed sequence of muscle groups. In addition, the number of muscle groups tensed and relaxed during the course of treatment is reduced, as opposed to making smaller and smaller muscle contractions as in Jacobson's original format. Moreover, in revised formats the therapist often speaks in a slower, softer, deeper voice when telling patients to relax in order to enhance hypnotic suggestion. Therefore, the revised methods combine somatic exercises with hypnotic suggestion to *induce* a sense of relaxation during a training session, as opposed to conducting muscular skill training as Jacobson's original method taught (Lehrer, 1982; Lehrer & Woolfolk, 1993).

Revised progressive relaxation techniques are reported to reduce symptoms related to stress in both laboratory (e.g., Shapiro & Lehrer, 1980; Throll, 1982) and field studies (e.g., Woolfolk, Lehrer, McCann, & Rooney, 1982; Bernstein & Carlson, 1993). In addition, revised progressive relaxation techniques are widely used by behavior therapists because they can be learned quickly, and can be taught to patients over the course of a few sessions with the assistance of tapes that the patient uses for practice at home (Lehrer, 1996). Although some evidence suggests that Jacobson's original method may have greater anxiolytic effects than revised methods, reviews indicate that further research is required to fully determine the relative strengths of the two methods (Lehrer, 1982; 1996). Some of the differences measured between the original and revised techniques may be accounted for by procedural variables, such as therapist-administered training versus automated (taped) training, length of

training, and the use of normal versus patient populations (Borkovec & Sides, 1979; Lehrer, 1982).

Researchers examining the difference between Jacobson's original technique and modern progressive relaxation training have noted that the modern methods make assumptions that have not been validated by controlled research (Lehrer, Batey, Woolfolk, Remde, & Garlick, 1988). These include: (1) repeated tense-release cycles using high levels of tension improve the patient's ability to perceive low levels of tension; (2) muscle tension automatically produces muscle relaxation immediately after the tension is released (i.e, a pendulum effect); and (3) paying attention to muscle sensations deepens relaxation (Lehrer et al., 1988). However, Jacobson's original method also required patients to focus their attention on discerning and eliminating muscle tension, which required them to shift their focus away from the stimulus causing muscle tension. It may be that relaxation is facilitated, in part, by focusing attention. The next section reviews another stress management technique in which attention focusing seems to be a key component in creating relaxation.

Music Therapy

Music therapy is another technique that is gaining wider notice as a useful method for stress management treatment. In an extensive review of music research in medical and dental settings, Standley (1986) noted that music has in fact been associated with the treatment of disease since ancient times, with the use of incantations to heal the sick. Modern uses of music therapy include: (1) music listening for anesthesia, analgesia, and/or suggestion; (2) music listening and/or participation for exercise and rehabilitation; (3) music listening

and/or participation as an adjunct to traditional counseling; (4) music listening and/or participation for developmental or educational objectives; (5) music listening as a stimulative treatment for comatose or brain damaged patients; (6) music listening to reinforce or structure biofeedback and self-regulatory treatments; and (7) music listening and/or participation as an adjunct to group therapies (Standley, 1986).

In a review of music therapy as a stress management technique, Hanser (1985) noted that the effects of music on human physiological responses have been investigated since the turn of the century, but that much of this work is difficult to interpret because of methodological problems. Despite the increased sophistication of modern instrumentation, inconsistencies are prevalent in more recent research as well. Music selection criteria and basic definitions of "relaxing" and "stimulative" or "happy" and "sad" have not been clarified or standardized. In addition, the advent of New Age music has introduced additional complexity to musical selections, with rhythmic and/or affective changes occurring within a single selection of music making classification difficult (Hanser, 1985). Compounding these methodological problems are results that suggest that the type of music that listeners find "relaxing" when comparing physiologic and self-report information is highly idiosyncratic (Davis & Thaut, 1989)

Despite these problems, reports indicate that music is effective as a means of relaxation and reducing stress (e.g., Miller & Bornstein, 1977; Reynolds, 1984; McCraty, Barrios-Choplin, Atkinson, & Tomasino, 1998). For example, music relaxation conditions are reported to be as effective as

progressive relaxation (Miller & Bornstein, 1977), as well as biofeedback and autogenic conditions (Reynolds, 1984) after one session of training, and still as effective as biofeedback and autogenic training after eight sessions of training (Reynolds, 1984). In addition, a combined music plus autogenic training condition was reported to be more effective than other non-combined relaxation treatments (Reynolds, 1984), suggesting that some methods of behavioral stress management may have specific and/or additive effects.

Classical music has been used in a number of studies, revealing both self-reported (McCraty et al., 1998), behavioral (Allen & Blascovich, 1994), and physiological (McKinney, Tims, Kumar, & Kumar, 1997; McKinney, Antoni, Kumar, Tims, & McCabe, 1997) changes that are related to reduced stress. For example, listening to classical music was associated with reductions in autonomic activity, self-reported tension, and improved performance of surgeons when they enjoyed the selection (Allen & Blaskovich, 1994). Similarly, listening to classical music in another study reduced self-reported fatigue, sadness, and tension, but degree of enjoyment or preference was not reported (McCraty et al., 1998). Previous work indicates that degree of liking for music is positively related to the degree of relaxation that listeners self-report (e.g., Stratton & Zalanowski, 1984). However, other studies indicate that the presence or absence of choice over music does not facilitate or inhibit the degree of relaxation that listeners self-report (Thaut & Davis, 1993).

Physiological changes associated with listening to classical music and related to reduced stress included significant decreases in beta-endorphin following one session of a combined progressive relaxation, classical music, and

imagery condition compared to a silent imaging, music listening, and a silence condition (McKinney et al.,1997a), and significant decreases in serum cortisol following 13 weeks of a similar Guided Imagery and Music (GIM) therapy (McKinney et al., 1997b). Other reports indicate that music facilitates imagery processes of listeners (e.g., McKinney,1990; Rider, 1985) and that imagery is associated with decreases in self-reported pain (Rider, 1985), as well as self-reported depression and fatigue (McKinney et al., 1997b). It is noteworthy that GIM therapy has a patient first engage in progressive relaxation, and then listen to a specific 35- to 45-minute sequence of classical music that is designed to allow the patient to shift their attention from their present condition to guided imagery that is generated by listening to music. Because the participants in these studies are guided through progressive relaxation as part of the music and imagery condition, it is unclear whether progressive relaxation, music, or the combination of relaxation and music is responsible for the enhanced imagery and reductions in distress measured in the study. It may be that the process of relaxation, achieved through either progressive relaxation, classical music, or the combination of both, facilitates the process of focusing on guided imagery. The next two sections present different explanations of relaxation to further explore this idea.

Explanations for Relaxation

An unresolved question in the stress management field is whether the techniques used to initiate relaxation all elicit a single “relaxation response” as proposed by Benson (Greenwood & Benson, 1977; Benson, 1975; Benson, Beary, & Carol, 1974), or whether they have specific effects, as proposed by

Davidson and Schwartz (1976). The relaxation response is characterized by physiologic responses consistent with decreased sympathetic nervous system activity (Greenwood & Benson, 1977). A number of physiological measurements consistent with this hypothesis have been obtained during activities that are reported to elicit the relaxation response, such as meditation techniques, autogenic training, hypnosis, and yoga (Benson et al., 1974). These measurements include: a marked decrease in oxygen consumption and carbon monoxide elimination with no change in respiratory quotient, decreases in respiratory rate, a marked increase in skin resistance, and an increase in the frequency of alpha wave activity with occasional theta wave activity (Greenwood & Benson, 1977). While positing that these physiologic responses occur during the relaxation response, Benson also acknowledges that "techniques which elicit the relaxation response incorporate the element of focused attention" (Greenwood & Benson, 1977, p. 337).

Instead of a general response that is elicited by all relaxation techniques, Davidson and Schwartz (1976) proposed that relaxation techniques have specific effects. That is, cognitively-oriented techniques may initiate specific cognitive relaxation effects, autonomically-oriented methods may initiate specific autonomic effects, and muscularly oriented techniques may initiate specific muscular effects. For example, progressive muscle relaxation might be expected to have predominantly somatic effects, because it emphasizes the development of a muscular skill. Similarly, autogenic training might be expected to generate both cognitive and somatic effects because it emphasizes achieving body homeostasis through repeated internal verbal instructions (a cognitive

process) that have somatic foci (e.g., my arms are heavy and warm, my legs are heavy and warm) (Smith, 1988; Lehrer & Woolfolk, 1993).

Limited support has been reported for the specific effects hypothesis. For example, a later study reported by this same lab concluded that the relaxing effects of meditation were primarily cognitive, because a person cannot simultaneously worry and repeat a verbal mantra (Schwartz, Davidson & Goleman, 1978). Another study by Lehrer and colleagues suggested that meditation had a relatively greater effect on decreasing symptoms of worrying, whereas progressive relaxation had a relatively greater effect on decreasing self-perception of somatic arousal (Lehrer, Schoicket, Carrington, & Woolfolk, 1980). However, this study was later criticized for not sufficiently controlling for possible baseline effects (Woolfolk, Lehrer, McCann & Rooney, 1982). These investigators noted, however, that methodological differences may have limited interpretation of studies examining different relaxation techniques for specific effects. Specifically, most relaxation techniques have overlapping general effects, while discerning specific effects of individual techniques requires additional subtypes of measurement under carefully controlled conditions (Woolfolk et al., 1982). A compromise position was developed from these reports which suggested that the specific effects of relaxation techniques may be superimposed upon a general "relaxation response" (Lehrer & Woolfolk, 1993).

Although the mechanisms for relaxation are still not fully understood, the arousal-reduction model has achieved widespread acceptance in the past 20 years. More recently, however, Smith (1988) proposed a cognitive-behavioral model of relaxation as an alternative explanation for relaxation. Smith raised a

number of issues in re-examining Benson's arousal-reduction explanation for the effects of relaxation, including the following:

Floor Effect. Unless subjects are experiencing severe emotional disturbance, maximum relaxation can be attained in the first session, and little training is required (Lehrer, 1978). However, other reports indicate that normal subjects report deeper and more rewarding levels of relaxation after years of practice (Smith, 1988).

Lack of Effect. Holmes (1984, 1987) suggested that the arousal-reducing effects of meditation are no better than simply sitting and reading, listening to music, resting, or doing nothing. These charges sparked a debate within the field about the merits of meditation as a valid relaxation technique (e.g., Benson & Friedman, 1985; Holmes, 1985a, 1985b; Shapiro, 1985; Smith, 1986; Suler, 1985; West, 1985). However, as discussed previously, stress management techniques may be useful behavioral supplements to traditional medical or psychotherapy, and with practice can increase a patient's sense of self-efficacy over stressful situations.

Relaxation-Induced Anxiety. Up to 40% of patients who learn relaxation techniques develop relaxation-induced anxiety (Heide & Borkovec, 1984). However, these reactions seldom occur to more than one technique. In addition, some patients report attaining a deep state of relaxation to a given technique, yet at the same time display physiological signs of increased arousal (Smith, 1988). These reports suggest that individuals engaged in relaxation techniques may have difficulties identifying physiological changes that occur during relaxation, consistent with reports that people have difficulties accurately perceiving their

internal states (e.g., Roberts & Pennebaker, 1995). It may be that some relaxation techniques are more effective than others because they provide more cognitive cues for individuals to use for labeling physiologic changes that they experience during relaxation.

Combinations of Techniques. Relaxation protocols that have been developed for use by stress management programs typically present a combination of techniques rather than a single technique. Most sequences start with progressive relaxation or stretching exercises, proceed to breathing and imagery, and end with meditation (e.g., Benson, 1975; Bernstein & Berkovec, 1973; Kapleau, 1965; Luthe, 1977).

Smith (1988) suggested that three elements are basic to all forms of relaxation. First, all forms of relaxation involve *focusing*, which he defined as the ability to differentiate, maintain focus on, and return attention to simple stimuli for an extended period of time. Second, relaxation requires *passivity* on the part of the participant, or the ability to stop unnecessary goal-directed and analytic activity. Third, relaxation requires *receptivity*, defined as the ability to tolerate and accept experiences that may be uncertain, unfamiliar, or paradoxical. In a more recent paper, Smith and colleagues (1996) suggested that relaxation may consist of three global factors: (1) "tension relief," to include the positive sensations, affects, and appraisals associated with reduced cognitive and somatic arousal; (2) "passive disengagement," used to describe the passivity dimension, or the reduced goal-directed and analytic activity; and (3) "passive engagement," similar overall to the receptivity dimension (Smith et al., 1996).

Overall, these global factors are remarkably similar to the components

that Benson and colleagues proposed were required for the relaxation response, namely, decreasing muscle tone, developing a passive attitude, limiting stimulus input, and concentrating upon a repetitively spoken word or activity (Greenwood & Benson, 1977). Smith and colleague's (1996) revision simply added a tension reduction component, making their cognitive-behavior model of relaxation more compatible with the arousal-reduction model. However, despite its apparent lack of originality, the cognitive-behavioral model may contribute some important points to our understanding of relaxation. First, the cognitive-behavioral model suggests that relaxation is a process that could result from any combination of these global factors, and that different combinations of focusing, passivity, receptivity, and arousal reduction may result in different levels of relaxation. Second, the cognitive-behavioral model highlights the importance of attentional focusing, the requirement of an individual to maintain focus on, and return focus to a simple stimuli for an extended period of time in order to achieve a relaxed state. This global factor alone may account for variety of methods and techniques that have been shown to be effective for stress management in clinical settings, and may also account for the variety of activities that people say they find relaxing (e.g., reading, watching television, playing computer games, etc.). Finally, it may be that relaxation exists on the other end of a continuum from stress, and by further defining and understanding the processes that occur that help a person to relax, we may gain further insights into the processes that contribute to becoming "stressed."

The cognitive-behavioral model of relaxation suggests that the global factors of relaxation individually or together may create relaxation for people in

their day-to-day activities. For example, a person may take a break from goal-directed activity at work to have lunch. The lunch break can result in some relaxing effect because it may involve the second component, passivity, if the person can direct his/her attention away from work-related matters. Another individual may take a break from goal-directed activity and have lunch with a group of colleagues. This break may be even more relaxing than the first example, because it could involve the second and third components, passivity and receptivity, assuming that the group of colleagues talks about something other than work, and they don't have lunch together routinely. A third individual may take his/her lunch break to play racquetball with a colleague. Their break may include three components, if that person is able to shift his/her attention from work-related tasks to the game, doesn't talk about work during the game, doesn't play racquetball routinely at lunchtime, and does not focus on winning the game. With an accompanied arousal reduction following the physical exercise, this last lunchtime activity may result in the greatest relaxation effect of the examples described.

In addition to daily activities, the global factors of relaxation--focusing, passivity, and receptivity--are what is fostered in a patient who is engaged in a relaxation component of a stress management program (Smith, 1988). For example, if patients were being trained in progressive muscle relaxation, then they would be trained to: (1) focus on and learn to distinguish between sensations of tension and release of tension; (2) stop focusing on the tension and become passive after each repetition; and (3) tolerate temporary frustration and discomfort until relaxation skills develop. Smith (1988) argues that all forms

of relaxation as well as all forms of relaxation training involve these components. That is, they all attempt to boost and refine the patient's ability to attend to a limited stimulus, to cease unnecessary goal-directed activity, and to accept experiences that may be uncertain, unfamiliar, or paradoxical. In order to test the cognitive behavioral model of relaxation in the present experiment, additional information on attention and attention measurement will be presented next.

Attention

Information-processing models of cognitive processes are based on the idea that an individual is an active processor of information, not merely a passive channel (Wesnes & Warburton, 1983). One of the assumptions of these models is that an individual has limited resources and so must allocate resources to processes on the basis of some sort of allocation strategy. A comprehensive examination of one such attention-allocation model is presented by Kahneman (1973). In this model, the performance of any activity (i.e., an experimental task) is associated with a certain amount of effort, and more difficult activities require more effort. For example, mentally multiplying two-digit numbers requires more effort than adding or subtracting two-digit numbers (Kahneman, 1973).

Moreover, in an attention allocation model, changes in arousal cause changes in allocation of attention and effort. Kahneman (1973) notes that this process is governed by the fundamental law that relates performance to arousal, the Yerkes-Dodson law. This law states that the quality of performance on any task can be described by an inverted U-shaped function of arousal, and that the range over which performance on the task improves with increasing arousal varies with the complexity of the task (Yerkes & Dodson, 1908). In general,

research findings indicate that under increased arousal, individuals have less attentional capacity available to allocate to activities. That is, their ability to focus attention on relevant external cues is reduced, resulting in decreased performance in terms of speed and accuracy (Kahneman, 1973). Conversely, under conditions of decreased arousal, performance should improve because additional attentional capacity is available to allocate to activities. Therefore, speed and accuracy on experimental tasks should improve immediately following relaxation if arousal is reduced. Measuring attentional processes immediately following relaxation and comparing the results with measurements made before the relaxation period could help to illustrate changes in attention that occur as a result of relaxation.

Neuropsychologists studying and measuring attention have defined this essential cognitive activity as a complex sets of processes associated with a multi-component system, each having a distinct function supported by different brain regions (Mirsky, Fantie, & Tatman, 1995; Mirsky, Anthony, Duncan, Ahearn, & Kellam, 1991). The conceptualized attentional processes are supported by evidence gathered from brain-lesioned patients, as well as component analyses of neuropsychological test battery data. Specific functions of the attention system include: (1) a "focus-execute" component, defined as a visual-perceptual ability to focus on specific environmental cues and to respond appropriately to them; (2) a "sustain" component, defined as responsible for the maintenance of vigilance or sustained attention; (3) an "encode" component, defined as primarily involved with numerical-mnemonic aspects of attention; and (4) a "shift" component, an executive function responsible for shifting attention

from one aspect or stimulus feature of the target to another aspect in an adaptive and flexible manner (Mirsky et al., 1995).

The results of component analyses suggest that the separate attention functions can be measured by a variety of attentional tasks (Mirsky et al., 1995). For example, the focus-execute element can be assessed using a letter-cancellation task. In this task, the subject scans rows of letters or numbers to find and cross out as many of an assigned target as possible within a given time, or until the completing the task, with time to completion scored. In order to control for practice effects, the subject may be asked to cross out a different target letter or number, or cross out more than one target. The encoding function is assessed using arithmetic tasks that require the subject to attend to and process basic arithmetic problems without the aid of paper and pencil (Mirsky et al., 1995).

In order to assess the effects of experimental manipulations of attention, researchers have used a variety of attentional tasks to measure theoretical sub-types of attention. For example, selective attention tasks measure a subject's ability to attend to a target stimulus while simultaneously ignoring irrelevant or distracting stimuli. Assessing a subject's performance on a selective attention task over a period of five to ten minutes is thought to measure focused attention. Measurements longer than ten minutes are thought to be indicative of sustained attention (Heishman, Taylor, & Henningfield, 1994).

Pencil-and-paper tasks such as letter cancellation tasks have been shown to be sensitive to experimental manipulations that result in central nervous system arousal. Specifically, a number of reports indicate that letter cancellation

tasks are sensitive to improved cognitive performance of smokers. For example, studies using letter cancellation tasks report that smoking increases the number of letters that smokers scan compared with sham smoking or presmoking baseline (e.g., Williams, 1980; Williams, Tata, & Miskella, 1984), as well as faster completion times after smoking compared with placebo (Parrott & Craig, 1992). These results suggest that a letter cancellation task would be sensitive to changes in cognitive performance as a result of other experimental manipulations of arousal.

In a similar manner, computer performance tasks have been developed to measure changes in cognitive performance that occur as a result of experimental or pharmacological manipulation. The Performance Assessment Battery (PAB), developed at the Walter Reed Army Institute for Research (WRAIR), is one such instrument. The WRAIR PAB is comprised of tasks that measure the complex performance tasks that are learned through repeated practice. The tasks included in the PAB were intended to provide face-valid models for a variety of activities required on a day-to-day basis in occupational settings, such as simple arithmetic, short-term memory, and visual vigilance. For each of the tasks, the dependent variables are speed and accuracy (Thorne, Genser, Sing, & Hegge, 1985).

PAB tasks also have been shown to be sensitive to experimental manipulations that result in central nervous system arousal (e.g., Snyder & Henningfield, 1989). Specifically, PAB tasks such as simple arithmetic and logical reasoning are reported to be sensitive to changes in the cognitive performance of smokers and non-smokers following nicotine administration and

deprivation (Snyder & Henningfield, 1989; Snyder, Davis, & Henningfield, 1989). These results suggest that PAB tasks would be sensitive to changes in cognitive performance as a result of other experimental manipulations of arousal. The next section will examine an additional component of attention that is reported to be sensitive to changes in arousal.

Self-Focused Attention

Another variable of interest in the present study is changes in self-focused attention as a result of increases or decreases in arousal. Self-focused attention refers to an "awareness of self-referent, internally generated information" (Ingram, 1990, p. 156). This construct was derived from self-awareness theory (Duval & Wicklund, 1972), which proposed a dichotomy between attention directed outward toward the external environment and attention directed inward toward the self. Individual differences in the tendency to self-focus have been documented (Fenigstein, Scheier, & Buss, 1975). In addition, self-focused attention responds to a variety of experimental manipulations. That is, any stimuli that remind a person of him or herself can increase self-awareness and result in increased self-focused attention. Two experimental conditions that are frequently used to manipulate self-focused attention include exposure to a mirror or video camera (Duval & Wicklund, 1972; Scheier & Carver, 1977). Increased self-focused attention is reported to have a number of cognitive, affective, and behavioral consequences, including: (1) intensify affective experience (Scheier & Carver, 1977); (2) encourage individuals to compare themselves to salient behavioral standards and to reduce perceived discrepancies between current behavior and salient standards (Scheier & Carver, 1980); and (3) lead to more

accurate reporting of personal characteristics and behaviors (Pryor, Gibbons, Wicklund, Fazio, & Hood, 1979). These reports suggest that self-focused attention is an important variable that may influence the degree to which individuals are able to focus their attention when engaging in a relaxation task.

Self-focused attention also is reported to be influenced by arousal. For example, subjects who were aroused by running quickly in place were reported to be more self-focused than those who ran slowly in place, those who sat in a chair, or those who reclined in a reclining chair (Wegner & Giuliano, 1980; 1983). These results suggest that subjects who are aroused by an experimental stressor may report an increase of self-focus compared to their baseline state, and then may report a decrease in self-focus following a relaxation task.

Other investigations have examined the effects of a public speaking task upon self-focused attention (e.g., Carver & Scheier, 1978; Daly, Vangelisti, & Lawrence, 1989). In this situation, individuals with high speech anxiety recalled less of the environment in which they gave their presentation, and recalled more self-focused thoughts that occurred to them during their speech than those individuals without high speech anxiety (Daly et al., 1989). In addition, the self-focused thoughts of high speech anxiety individuals were more negative than those of low-anxious speakers, consistent with previous work in which socially anxious people reported more negative self-focused thoughts and higher self-consciousness than socially non-anxious individuals (Scheier, Carver, & Colding, 1985). These reports suggest that speech anxiety and self-focused attention are variables that must be measured when using a public speaking task as an experimental stressor, in order to control for the differential effects that negative

self-focused thoughts may have on other measurements of attention, stress, and relaxation.

Summary

The cognitive-behavioral model of relaxation (Smith, 1988; Smith et al., 1996) suggests that relaxation involves three elements -- focusing, passivity, and receptivity -- as opposed to the specific-effects model, which posits that relaxation techniques have specific effects, and the arousal-reduction model, which proposes that relaxation is achieved simply through physiologic arousal reduction. According to the cognitive-behavioral model, relaxation is achieved when a person stops previous goal-directed activity, focuses attention on simple stimuli, is receptive to relaxation experiences, and may or may not experience a reduction in arousal. These conditions can be created in the laboratory in order to examine the different explanations for relaxation.

The present experiment was designed to examine the process of relaxation within a framework of the cognitive-behavioral model. Normal volunteers were exposed to a stress manipulation and then to one of two relaxation (Progressive Relaxation, Music) or control (Attention Control, Silence) conditions. Measurements of attention, relaxation, and stress responses were obtained during each phase of the experiment in order to examine the specific cognitive and behavioral components of relaxation (passivity, focus, and receptivity) proposed by the cognitive-behavioral model of relaxation. The relaxation and control conditions were selected to examine cognitive, behavioral, and physiological factors thought to be involved in the relaxation process in order to examine: (1) their individual and/or combined or hierarchical effects, (2)

whether different relaxation techniques had separate effects, or (3) whether relaxation techniques resulted in a generalized "relaxation response."

Specifically, a Progressive Relaxation condition was used to expose subjects to all three elements that, based upon the cognitive-behavioral model of relaxation, are thought to be essential to the process of relaxation, namely, focusing, passivity, and receptivity. Subjects in this condition were given a break from an experimental stressor (writing a short speech) in order to listen to a 15-minute progressive relaxation tape. The tape lead them through a series of ten muscle contraction-relaxation sequences. By following the instructions contained on the tape, subjects took a break from their previous goal-directed activity (passivity), focused on the voice contained on the tape (focusing), and were required to complete a series of unfamiliar muscle tensing-relaxing exercises (receptivity). Subjects in a Music condition also were given a break from the experimental stressor, but listened to a 15-minute taped segment of classical music. This condition also allowed subjects to take a break from goal-directed behaviors (passivity), and provided a simple stimulus for subjects to focus their attention on (focusing), but did not require them to engage in a series of unfamiliar exercises. Subjects in the Attention Control condition focused on a taped task (focusing), but were not given a break from goal-directed activities. Finally, subjects in the Silence condition were provided a break from the experimental stressor (passivity), but were not provided with a tape to listen to as a simple stimulus to focus their attention upon, nor did they have to tolerate an unfamiliar relaxation experience.

In summary, the present experiment measured attention, relaxation, and

stress responses of subjects during each phase of the experiment in order to examine the specific cognitive and behavioral components proposed by the cognitive-behavioral model of relaxation. Because the cognitive-behavioral model of relaxation has not been adequately evaluated experimentally (Lehrer & Woolfolk, 1993), this experiment was designed as an initial investigation of this alternative explanation for the processes inherent in behavioral stress management programs. Moreover, because the use of alternative therapies, including stress management, is highly prevalent (Eisenberg et al., 1998), it is important to fully understand the basic mechanisms by which relaxation occurs.

OVERVIEW

The purpose of the present experiment was to examine the effects of four different conditions (Progressive Relaxation, Music, Attention Control, and Silence) on levels of attention, relaxation, and stress responses in healthy, male human subjects in a between-subjects design. Specifically, 67 healthy men were recruited to participate in an experiment that was advertised as an investigation of communication processes. Subjects were screened by telephone prior to the experiment, and were quasi-randomly assigned to the separate experimental conditions in order to balance experimental groups based upon screening information (e.g. age, time of day subjects could participate). All subjects (who provided written and verbal consent to participate) were assessed for baseline self-report, physiological (e.g., heart rate, blood pressure), and behavioral data, and provided a saliva sample to be assayed for salivary cortisol. Next, subjects were asked to prepare a five-minute speech ostensibly to be videotaped at the end of the 15-minute speech preparation period. Following this period, subjects completed a 15-minute stress management or control task based on group assignment. Subjects assigned to the Progressive Relaxation condition listened to a 15-minute taped relaxation exercise; those assigned to the Music condition listened to a 15-minute tape of classical music; those assigned to the Attentional Control condition listened to a 15-minute taped auditory memory task, and those assigned to the Silence condition sat quietly for 15 minutes. All subjects completed behavioral and self-report measures of attention, relaxation, and stress before and after each condition. Subjects then completed a

psychophysical measure as an index of stress, again completed the self-report measures, and provided a second saliva sample for later salivary cortisol assay. After collecting these measurements, the experiment was stopped, and subjects were debriefed and paid for participating.

MAJOR HYPOTHESES

For purposes of examining relaxation processes within the cognitive-behavioral model of relaxation, it was presumed that a Progressive Relaxation condition exposed subjects to all three elements essential to the process of relaxation, namely, focusing, passivity, and receptivity. Subjects in this condition were given a break from an experimental stressor (writing a short speech) in order to listen to a 15-minute progressive relaxation tape. The tape lead them through a series of ten muscle contraction-relaxation sequences. By following the instructions contained on the tape, subjects took a break from their previous goal-directed activity (passivity), focused on the voice contained on the tape (focusing), and were required to complete a series of unfamiliar muscle tensing-relaxing exercises (receptivity).

Subjects in a Music condition also were given a break from the experimental stressor, but listened to a 15-minute taped segment of classical music. This condition also allowed subjects to take a break from goal-directed behaviors (passivity), and provided a simple stimulus for subjects to focus their attention on (focusing), but did not require them to engage in a series of unfamiliar exercises. Subjects in the Attention Control condition focused on a taped task (focusing), but were not given a break from goal-directed activities. Finally, subjects in the Silence condition were provided a break from the experimental stressor (passivity), but were not provided with a tape to listen to as a simple to focus their attention upon, nor did they have to tolerate an unfamiliar relaxation experience. Based upon this rationale, four hypotheses were

developed to describe the predicted differences between the relaxation and control conditions, and four hypotheses were developed to describe the predicted ranking of the four groups by the cognitive-behavioral model of relaxation based upon the hierarchical factors in each group.

Hypothesis 1a: It was hypothesized that the relaxation conditions (Progressive Relaxation and Music) would result in higher scores on behavioral and self-report measures of **attention** than the control conditions (Attentional Control and Silence).

Hypothesis 1b: It was hypothesized that the Progressive Relaxation condition would result in the highest scores on behavioral and self-report measures of **attention**, followed by subjects in the Music condition, followed by the Attention Control condition, followed by the Silence condition.

Hypothesis 2a: It was hypothesized that the relaxation conditions (Progressive Relaxation and Music) would result in the higher scores on behavioral and self-report measures of **relaxation** than the control conditions (Attentional Control and Silence).

Hypothesis 2b: It was hypothesized that the Progressive Relaxation condition would result in the highest scores on behavioral and self-report measures of **relaxation**, followed by the Music condition, followed by the Attentional Control condition, followed by the Silence condition (relaxation behaviors will not be obtained from the Attentional Control group).

Hypothesis 3a: It was hypothesized that the relaxation conditions (Progressive Relaxation and Music) would result in the lower self-report, biochemical, and physiological indices of **stress** than the control conditions

(Attentional Control and. Silence).

Hypothesis 3b: It was hypothesized that the Progressive Relaxation condition would result in the lowest self-report, biochemical, and physiological indices of **stress**, followed by the Music condition, followed by the Attentional Control condition, followed by the Silence condition.

Hypothesis 4a: It was hypothesized that the relaxation conditions (Progressive Relaxation and Music) would result in the lower responses on a **psychophysical measurement of stress** than the control conditions (Attentional Control and Silence).

Hypothesis 4b: It was hypothesized that the Progressive Relaxation condition would result in the lowest responses on a **psychophysical measurement of stress**, followed by the Music condition, followed by the Attentional Control condition, followed by the Silence condition.

METHODS

Subjects

Eighty-five healthy men between the ages of 18 and 67 were recruited to participate in this experiment. Local newspaper advertisements and publicity flyers were used to recruit subjects. Subjects were paid thirty dollars for their participation. Data from six subjects were subsequently excluded because their responses to a self-report measure of psychopathology fell outside of two standard deviations of scores obtained for all subjects who participated in the experiment. Another individual's responses were not included because of his previous experience with meditation, which also was an exclusion criterion. In addition, eleven male smokers were run as pilot subjects for a future experiment examining smoking and relaxation. Excluding these data resulted in a final sample size of 67. This study was restricted to male subjects as an initial investigation regarding stress and relaxation. Because previous work indicates gender differences in relaxation (e.g., Roberts & McGrady, 1996), this study focused on one gender.

Experimental Design

The present experiment used a between-subjects design to examine the effects of two stress management conditions (Progressive Relaxation and Music) and two control conditions (Attention Control and Silence Condition) (See Table 1). The completed study had 17 subjects in the Progressive Relaxation, Music, and Attention Control conditions, and 16 subjects in the Silence Condition, for a total of 67 subjects. Prior to the experiment, a sample size of 64 subjects was

estimated to be sufficient to find significance based upon data from previous studies of stress, cognitive processes, and behavioral responses (Klein, Faraday, & Grunberg, 1996; Kirschbaum & Hellhammer, 1994; Grunberg & Klein, 1995; Acri & Grunberg, 1992), as well as upon information provided by another investigator (S. Heishman, personal communication, 1998). In addition, this sample size estimate was corroborated by performing a power analysis based upon data from previous studies that used the Walter Reed Computerized Performance Assessment Battery (PAB; Snyder & Henningfield, 1989; Heishman, Snyder, & Henningfield, 1993). The effect size of this computerized performance task was estimated to be the smallest of the variables to be measured in this experiment, and therefore would result in the most conservative estimate of sample size required to obtain significant results. Means and standard deviations of response times on selected computerized performance tasks were used to calculate the sample size required to determine significance at an alpha level of .05 and a power level of 0.80 according to standard statistical procedures (Cohen, 1988). Using these criteria, it was estimated that 16 subjects would be required per cell for a total of 64 subjects.

<u>Telephone Screening and Subject Assignment</u>

Each subject was asked to provide information as part of an initial telephone screening prior to the experiment proper (see Appendix I for a copy of the telephone screening form). Subjects were excluded from participating in the study if they indicated that they were not U.S. citizens, if they were not native English speakers, if they had less than the equivalent of a high school degree, if they were active-duty military personnel, if they endorsed items that indicated

any major medical problems, psychopathology, learning or attentional disorders, or if they reported using medication that indicated one of these conditions. These exclusion criteria were used to minimize the experimental error introduced into the sample from individual difference variables. Embedded within the screening questionnaire were ten items from the Personal Report of Communication Apprehension (McCroskey, 1970; 1978), to assess for baseline level of anxiety in response to a speech task. Subjects were assigned to the experimental conditions quasi-randomly (balancing for age, initial speech anxiety level, and time of day that subjects would participate) prior to their participation in the experiment. All subjects were run between 9:00 a.m. and 8:00 p.m., Monday through Saturday.

Human Subjects Protection

Subjects were informed about the nature and purpose of the study at the beginning of the telephone screening in order to determine if they were willing to spend the two hours necessary to participate. Subjects were again informed of the nature and purpose of the experiment at the beginning of the laboratory session, after which informed consent was be obtained. All subjects were thoroughly informed of their right to discontinue participation at any time during the study (see Appendix II for a copy of the Informed Consent form). At the conclusion of the experiment, all subjects were debriefed about the experiment as approved by the USUHS Institutional Review Board (IRB). In addition, subjects who endorsed a high level of psychopathology on the Brief Symptom Inventory were counseled for an additional 15 to 30 minutes after the conclusion of the experiment, and encouraged to seek additional treatment as appropriate.

Procedure

Table 2 presents a timeline of the experimental procedures. Upon arrival, subjects were **taken to the experimental suite** which contained two chairs and a small table which had the following equipment set up on it: a computer, a notepad and pencils, an ice bucket, a pitcher of water and Styrofoam cup, and a blood pressure cuff from a blood pressure and heart rate monitor which was positioned outside of the room. Subjects were welcomed to the study and thanked for coming. Each subject was then given the following **introductory monologue:**

> As we discussed on the telephone, this study is concerned with effective communication. We're interested in this topic for a couple of reasons. First, we train medical students at this school, and by learning more about the processes involved we may be able to more effectively convey material in our lectures. Also, we train the medical students about these processes so that they can more effectively communicate with patients. In this study, we are especially interested in the physiological and cognitive components that are involved in preparing to convey information to others, and the equipment that you see here on the table is designed to measure these components. In this study, you will fill out some questionnaires, complete some computer and paper-and-pencil tasks, and complete some tape-recorded exercises. We'll measure your heart rate and blood pressure at various times during the study, and also ask you to give saliva samples. Before we go any further, please read over this consent form.

Subjects were provided with a consent form and the experimenter reviewed it with them section by section. After reviewing the consent form, subjects were given any additional time needed to read over it, and were asked to initial each page in the spaces provided on the first two pages, and sign the third page if they agreed to participate in the study (please see Appendix I for a copy of the Informed Consent form). After obtaining **informed consent,** the experimenter began baseline measurements. All subjects were told the following information:

> As I said in the introduction, we will be measuring your heart rate and blood pressure at various times throughout the study. For this reason, I am attaching this blood pressure cuff to your arm, and request that you do not move it while it is attached during today's study.

After attaching the blood pressure cuff, all subjects were asked to give a saliva sample for later salivary cortisol measurement. All subjects were told:

> The first measurement that we need is a sample of your saliva. Please rinse your mouth and then swallow some water from this cup [subjects will be given the Styrofoam cup with water to drink from the pitcher]. Now, please spit or drip some saliva from your mouth into this tube, providing enough saliva to fill the tube to the thick black line marked on it. [Subjects will be give a sample tube to spit into. Samples will be placed in the ice bucket containing crushed dry ice immediately after they are collected.]

Each subject then was asked to complete a letter cancellation task and three computerized performance assessment battery (PAB) tasks as **baseline behavioral measurements of attention.** After completing these tasks, all subjects then completed **baseline self-report measurements,** including the

Profile of Mood-state questionnaire (POMS-SF; Shacham, 1983), the Positive and Negative Affect Scale (PANAS; Watson, Clark, & Tellegen, 1988), and visual analog scale (VAS) measures of attention, stress, and attentional focus (See Appendix I for copies of all written instruments used in the experiment). After completing these tasks, subjects were then asked to rest quietly for five minutes while **baseline heart rate and blood pressure measurements** were taken.

Stress Manipulation. After completing the baseline period, all subjects were **escorted to the speech preparation room** which contained a desk, chair, a notepad and pencils, a blood pressure and heart rate monitor, and a video camera, monitor, and videocassette recorder. Subjects were asked to sit in the chair, and the blood pressure cuff was re-attached. Subjects were then told the following **stress monologue:**

> You are to prepare a five-minute speech concerning your personal faults or undesirable habits; those aspects of your behavior or personality with which you are not happy. We use this topic because each person in the study is equally familiar with it, and it is relatively difficult to talk about. The speech will be video-taped, and will be evaluated by a panel of psychologists for the quality of the speech, the style of presentation, and the content of the speech. Try to make the speech as organized as possible because the quality, content, and style will be evaluated. I will leave the room for 15 minutes to give you **time to prepare your speech.** Then, when I come back, you will be able to take a short break prior to recording your speech. While you are preparing your speech, your blood

pressure and heart rate will be measured periodically. I will return in 15 minutes.

This procedure has been used in previous research and has been shown to be an effective, mild stressor with no lasting, deleterious effects (e.g., Morokoff, Baum, McKinnon & Gillilland, 1987; Rozanski et al., 1988). **Heart rate and blood pressure measurements** were taken at the beginning, middle and end of this 15-minute period.

Progressive Relaxation Condition. After the 15-minute speech preparation period, the experimenter returned to the room and had subjects again complete a letter cancellation task as a **behavior measure of attention,** and complete **self-report measurements** of attention, stress, and attentional focus (POMS-SF and VAS). After completing these tasks, subjects assigned to this experimental condition were then told the following:

> At this point in the study, we have a room next door where you can relax before we continue. Please follow me next door.

These subjects were **escorted to the experimental condition room** containing a chair and a desk, with a notepad and pencils and a computer on the desk. They were invited to sit in the chair and the blood pressure cuff was re-attached. All subjects in this experimental condition then were given the following **experimental condition monologue:**

> While you are resting here for a few minutes, I have prepared a tape that conducts a relaxation exercise. I will start the tape in a moment. The directions for this exercise will be read to you by a voice on this tape. Please listen to the directions on the tape, and complete the relaxation

exercise as prompted by the tape. Are you ready? I am starting the tape now.

The experimenter left the room to allow the subject to complete a 15-minute taped progressive muscle relaxation exercise. The tape consisted of a series of instructions designed to have listeners alternately tense and then relax ten different muscle groups. This type of relaxation tape has been shown to be effective for relaxation in previous research (e.g., Hoelscher, Lichstein, Fisher, & Hegarty, 1987; Sherman, 1982). **Heart rate and blood pressure measurements** were taken at the beginning, middle, and end of this fifteen-minute period. The experimenter observed and recorded **behavioral relaxation measurements** during the final five minutes of the relaxation period. At the conclusion of the 15-minute tape, the experimenter re-entered the room and had subjects complete three computerized performance assessment battery (PAB) tasks and a letter cancellation task as **behavior measurements of attention.** Subjects then completed **self-report measurements** of attention, stress, and attentional focus (POMS-SF and VAS).

Music Condition. After the 15-minute speech preparation period, the experimenter returned to the room and had subjects again complete a letter cancellation task as a **behavior measure of attention,** and complete **self-report measurements** of attention, stress, and attentional focus (POMS-SF and VAS). After completing these tasks, subjects assigned to this experimental condition were then told the following:

At this point in the study, we have a room next door where you can take a short break before we continue. Please follow me next door.

Subjects were then **escorted to the experimental condition room** containing a chair and a desk, with a notepad and pencils and a computer on the desk. Subjects were invited to sit in the chair and the blood pressure cuff was re-attached. All subjects in this experimental condition were then given the following **experimental condition monologue:**

> While you are resting here for a few minutes, I have prepared a tape with some music. Please sit quietly in your chair and listen to the music. I'm going to step out while you take a break and listen to the music, and then when I return we'll complete the study. Are you ready? I am starting the tape now.

The experimenter then left the room to allow the subject to listen to a 15-minute tape of a Mozart piano sonata. **Heart rate and blood pressure measurements** were taken at the beginning, middle, and end of this fifteen-minute period. The experimenter observed and recorded **behavioral relaxation measurements** during the final five minutes of this experimental period. At the conclusion of the 15-minute tape, the experimenter re-entered the room and had subjects complete three computerized performance assessment battery (PAB) tasks and a letter cancellation task as **behavior measurements of attention.** Subjects then completed **self-report measurements** of attention, stress, and attentional focus (POMS-SF and VAS).

Attention Control Condition. After the 15-minute speech preparation period, the experimenter returned to the room and had subjects again complete a letter cancellation task as a **behavior measure of attention,** and complete **self-report measurements** of attention, stress, and attentional focus (POMS-SF

and VAS). After completing these tasks, subjects assigned to this experimental condition were then told the following:

> We are interested in measuring your cognitive functioning prior to giving your speech. In order to do so, I would like you step in to the next room where we will be able to take some basic measurements of your current cognitive state. Please follow me next door.

These subjects were **escorted to the experimental condition room** containing a chair and a desk, with a notepad and pencils and a computer on the desk. The subject was asked to sit in the chair and the blood pressure cuff was re-attached. All subjects in this experimental condition were then be told the following **experimental condition monologue:**

> The first task that we will use to measure your current cognitive functioning is contained on this tape. I will start the tape in a moment. The directions for this task will be read to you by a voice on this tape. You simply listen to the directions on the tape, and complete the task as prompted by the tape. Are you ready? I am starting the tape now.

The experimenter then left the room to allow the subject to complete a 15-minute tape exercise, consisting of the Weschler Memory Scale (WMS-III; The Psychological Corporation, San Antonio, Texas), and a "Silly Sentence Task" (Mesulam, 1985) as prompted by the tape. **Heart rate and blood pressure measurements** were taken at the beginning, middle, and end of this 15-minute period. At the conclusion of the 15-minute tape, the experimenter re-entered the room, and had subjects complete three computerized Performance Assessment Battery (PAB) tasks and a letter cancellation task as **behavior measurements**

of attention. Subjects then completed **self-report measurements** of attention, stress, and attentional focus (POMS-SF and VAS).

Silence Condition. After the 15-minute speech preparation period, the experimenter returned to the room and had subjects again complete a letter cancellation task as a **behavior measure of attention,** and complete **self-report measurements** of attention, stress, and attentional focus (POMS-SF and VAS). After completing these tasks, subjects assigned to this experimental condition were then told the following:

> At this point in the study, we have a room next door where you can take a short break before we continue. Please follow me next door.

The subjects were then **escorted to the experimental condition room** containing a chair and a desk, with a notepad and pencils and a computer on the desk. The subject was invited to sit in the chair and the blood pressure cuff was re-attached. All subjects in this experimental condition were given the following **experimental condition monologue:**

> Now you may take a short break. Please sit quietly in your chair. I'm going to leave the room now while you take your break, and when I return we'll complete the study.

The experimenter then left the room to allow the subject to sit in silence for 15 minutes. **Heart rate and blood pressure measurements** will be taken at the beginning, middle, and end of this fifteen-minute period. The experimenter observed and recorded **behavioral relaxation measurements** during the final five minutes of the relaxation period. At the conclusion of the 15-minute period, the experimenter re-entered the room and had subjects complete three

computerized performance assessment battery (PAB) tasks and a letter cancellation task as **behavior measurements of attention.** Subjects then completed **self-report measurements** of attention, stress, and attentional focus (POMS-SF and VAS).

Final Stress Measurement Period. After subjects completed their assigned experimental condition, they were **taken back to the speech preparation room** containing the chair, desk, blood pressure and heart rate monitor, and video recording equipment. Subjects were asked to sit in the chair, and the blood pressure cuff was re-attached. All subjects then were instructed to complete the Reactive Irritability Scale (RIS-II), followed by final self-report measurements using the POMS-SF and VAS measures of attention, stress, and desire to smoke. All subjects were given the **final stress measurement monologue:**

> Now we are ready to have you record the speech that you prepared. However, before we start taping, there are some final measurements that we want to take. First, I would like you to listen to a tape of everyday sounds. You will be asked to rate these sounds as to how irritating they are to you **(Reactive Irritability Scale Task, RIS-II)**. All of the instructions for listening to the tape and filling out the forms will be explained by the tape itself. As you listen to the instructions, please read along with the typewritten instructions in front of you. The sound level has been set to a predetermined level, so please do NOT change it. Are you ready to begin? OK. Please place the headphones over your ears and press start to begin the task.

Heart rate and blood pressure measurements were taken during the beginning, middle, and end of this task. When subjects completed this task, they were asked to **complete self-report measurements** (POMS-SF and VAS). Then, all subjects were asked to give a saliva sample for later salivary cortisol measurement, using the following **monologue:**

> We need another sample of your **saliva.** Please rinse your mouth with some water from this cup. [Subjects will be given a Styrofoam cup of water to drink.] Now, please spit into this tube, providing enough saliva to fill the tube to the line marked on it. [Subjects will be given a sample tube to spit into.]

After collecting the saliva sample (assayed later for salivary cortisol) from all subjects, the experimenter stopped the experiment, and had subjects complete some **final self-report measures.** When subjects completed these final measurements, the experimenter thanked them for participating and debriefed them. During debriefing, subjects were also questioned about their previous experience with relaxation or stress management. One subject indicated that he had extensive experience with meditation, therefore, his data was excluded from the final sample. In addition, one of the final self-report measures that subjects completed was a measure of psychological distress (Brief Symptom Inventory, BSI). The experimenter calculated the subject's total BSI score while the subject completed the remaining self-report measures. Six of the subjects endorsed numerous items on this questionnaire indicating a high level of psychological distress. For each of these subjects, the experimenter spent an additional 20 to 30 minutes during debriefing to assess the nature of the subject's distress, and

1988). This 20-item, 5-point Likert-format scale instrument was used to obtain measurements of positive affect (PA) and negative affect (NA), two major underlying dimensions of mood reported to correspond to affective trait dimensions of positive and negative emotionality, corresponding to extraversion and anxiety/neuroticism, respectively (Watson, Clark, & Tellegen, 1988). The instructions for this instrument were set to indicate the past few weeks (i.e., "Indicate to what extent you have felt this way during the past few weeks") in order to reduce error variance associated with asking people to characterize how they "usually" feel (Stone, 1995). Using this setting, the PANAS scales have been reported to demonstrate adequate reliabilities (alphas = +0.87 for PA scale, +0.87 for NA scale) and validities (r = 0.58 for PA scale, 0.48 for NA scale) (Watson, Clark, & Tellegen, 1988) [Please see Appendix I for a copy of the Positive and Negative Affect Scale]. This instrument was used to determine if baseline differences of positive and negative affect existed between the experimental groups. Any baseline differences would then be used as co-variates on subsequent analyses of self-report measures related to mood, as appropriate.

Profile of Mood State (POMS-SF; Shacham, 1983). The Profile of Mood State (POMS) is a widely-used self-report instrument assessing psychological distress. The short-form version (POMS-SF) uses 37 of the 65 original adjectives in a 5-point Likert response format and yields both the global distress score (referred to as Total Mood Disturbance), as well as the six subscale scores obtained from the original POMS: Fatigue-Inertia, Vigor-Activity, Tension-Anxiety, Depression-Dejection, Anger-Hostility, and Confusion-Bewilderment. The Total

Mood Disturbance and subscale scores of the POMS-SF are reported to correlate highly with the original instrument (all *r*s > 0.95), and internal consistencies of POMS-SF scales are reported to be as good (alphas ranging from +0.80 to +0.91) as the original instrument (alphas ranging from +0.74 to +0.91) (Shacham, 1983; Curran, Andrykowski, & Studts, 1995) [Please See Appendix I for a copy of the POMS-SF]. This measure was used in the present experiment to assess subject's self-reported changes in moods related to the hierarchical elements of relaxation proposed by the Cognitive-Behavioral model of relaxation (i.e., focusing, passivity, and receptivity).

Visual Analog Scales (VAS). This instrument was constructed for this experiment to measure self-reported states of attention, stress, and attentional focus. It consisted of four visual analog scale (VAS) items, and directed the subject to place a mark on each 100-millimeter line to indicate to what extent they are experiencing the qualities denoted at either pole. Attention was assessed using the descriptors "Extremely Focused" and "Extremely Distracted" as anchors at opposite poles. Stress was assessed using the descriptors "Very Tense" and "Very Relaxed." Attentional focus was assessed using "I'm thinking about the next task" and "I'm thinking about how I am doing" as the anchor points at each pole [Please see Appendix I for a copy of the Visual Analog Scales].

Perceived Stress Scale (PSS; Cohen, Kamarck, & Mermelstein, 1983). The 4-item version of the PSS was used in the present study to assess how unpredictable, uncontrollable, and overloaded respondents find their lives in general, issues that are reported to influence the experience of stress (Cohen & Lichtenstein, 1990). This instrument uses a 5-point Likert-format scale to

measure of how much perceived stress the respondents have experienced within the past month. PSS-4 norms are available from a national sample of men (N = 2,387) in the United States, which reported the mean level for men to be 4.2 (Cohen & Williamson, 1988). The PSS has been found to have adequate internal consistency (alpha = +.85) and stability (r = +.85) (Cohen et al., 1983). This instrument was used to determine if baseline differences of perceived stress levels existed between groups of subjects. Any baseline differences would then be used as co-variates on subsequent analyses of stress measures, as appropriate. [Please see Appendix I for a copy of the PSS].

Brief Symptom Inventory (BSI; Derogatis & Melisartos, 1983). The BSI is a 49-item, multi-dimensional instrument designed to measure nine psychological symptom clusters, ranging from anxiety and depression to somatization. The Brief Symptom Inventory was designed to assess levels of psychological distress of psychiatric and medical patients, as well as individuals who are not patients. The BSI is essentially the shortened version of the SCL-90-R, a self-report inventory that has been developed and used in a wide variety of settings and applications. The BSI has demonstrated adequate internal consistency (alphas of +.71 or greater on all nine subscales) and reliability (r's ranging from +.68 to +.90) (Derogatis & Melisartos, 1983). This instrument was administered to screen for psychopathology in the experimental sample. Six of the subjects recruited to participate in the present experiment endorsed numerous items on this questionnaire indicating a high level of psychological distress. For each of these subjects, the experimenter spent an additional 20 to 30 minutes during debriefing to assess the nature of the subject's distress, and encouraged these

subjects to seek additional mental health treatment, as appropriate. Data collected from these subjects (whose total score on the BSI was greater than two standard deviations from the mean of all subjects who participated in the study) were subsequently excluded from subsequent analyses. [Please see Appendix I for a copy of the BSI].

Cognitive-Somatic Anxiety Questionnaire (CSAQ; Schwartz, Davidson, & Goleman, 1978). The CSAQ consists of 14 five-point Likert-format scale formatted self-report items that load into two subscales (Cognitive and Somatic) that are designed to assess these two aspects of the multi-dimensional features of anxiety. This instrument was developed without conducting conventional psychometric analyses, however, studies using the CSAQ with college student populations report that these two distinct factors emerge in factor analyses (e.g., Crits-Cristoph, 1986; Steptoe & Kearsley, 1990). This instrument was administered to assess and control for overall differential sensitivity to cognitive or somatic anxiety among the four experimental groups.

Music Questionnaire. This instrument was constructed for this experiment to measure self-reported preference for the music selection used during the experimental period with the Music group. The questionnaire was also administered to subjects in the Silence group to control for extreme responses by the subjects in the Music group. The questionnaire consisted of six 5-point Likert-format scale formatted items, and four fill-in items that were designed to collect musical preference data, and subjects' responses to the music used in the present study. For subjects in the Silence condition, item 9 was changed to read "Please describe what you were thinking about during the break in today's

experiment," and item 10 was crossed out [Please see Appendix I for a copy of the Visual Analog Scales].

Behavioral measures.

Letter Cancellation Scores. The Digit Vigilance Test (DVT; Psychological Assessment Resources, Odessa, Florida) was used for this task. The DVT is a paper-and-pencil task consisting of two 8 ½ x 11-inch pages with 980 integers (between zero and nine) arranged in 28 rows of 35 numbers in each row on each page. Subjects were administered only one page of the DVT at each administration, using standardized administration instructions. For the first administration, subjects were given page one of the DVT and a pencil and were asked cross out all of the sixes as quickly and accurately as they can. For the second administration, subjects were again asked to cross out all of the sixes as quickly and accurately as they can, but on page 2 of the DVT, which consisted of a new stimulus field of numbers in order to control for practice effects. For the third administration, subjects were again given page 1 of the DVT with a pencil. However, for this administration, subjects crossed out all of the nines instead of all the sixes, again to control for practice effects. Time to complete each administration as timed by a stopwatch, and accuracy of crossing out target numbers were scored for each administration.

Performance Assessment Battery (PAB) Scores. Three tasks from the Walter Reed Performance Assessment Battery (PAB; Thorne, Genser, Sing, & Hegge, 1985) were used to measure focused attention of all subjects during the baseline period and immediately following the experimental condition period. All subjects were given standardized instructions prior to each task, and any

questions they had about these instructions were answered before they started each task. Measurements of subjects' speed and accuracy completing each trial on each of the computerized tasks were obtained by the computer. The first task assessed subjects' relative speeds using a numeric keypad by having subjects complete a 50-item simple response time task in which the numbers zero through nine will be presented on the center of a computer screen, and response times and accuracy selecting that numeral on the keyboard's numeric keypad were measured. The second task consists of 50 rapid arithmetic problems, in which two digits are sequentially presented in the center of a computer screen followed by either a plus or a minus sign. Subjects were instructed before this task to perform the indicated addition or subtraction and to enter the answer on the keyboard's numeric key pad. If the answer to an addition problem was a two-digit number, the correct answer was obtained by entering the last digit (i.e., 7, 6, +, = 13; enter "3"). If the answer to a subtraction problem was a negative number, the correct answer was obtained by adding ten to the negative number and entering the result (i.e., 3, 7, -, = -4; enter "6"). A maximum time of 60 seconds was allowed for each trial for this task. The third task consisted of 10 letter-search problems, in which six alphabetic characters were presented at the top of a computer screen, and a random string of 24 letters was presented immediately below. The object of this task was to identify the six letters from among the 24 letter-string, which may have contained none, some, or all of the target letters. A maximum of 90 seconds for each trial was allowed on this task.

The PAB has been used in previous studies of changes in cognitive performance (e.g., Snyder & Henningfield, 1989; Snyder, Davis, & Henningfield,

1989). The three tasks described above were chosen to be easy enough for subjects to learn during baseline training, but difficult enough to reveal changes induced by subsequent experimental manipulations.

Relaxation Behaviors. Behavioral observations of subjects in the Progressive Relaxation, Music, and Silence Condition groups were made using the Upright Relaxation Scale, a variation of the Behavioral Relaxation Scale (BRS) (Poppen 1988). The BRS consists of a description of 10 postures or behaviors characteristic of a of a fully relaxed person whose body is fully supported by a reclining chair. The Upright Relaxation Scale uses a similar procedure, except that the behavioral scoring is slightly modified to score postures or behaviors characteristic of a fully relaxed person in an upright chair. The behaviors that are scored include the following: (1) Back -- the spine is perpendicular to the floor, with the shoulder blades and the buttocks touching the back of the chair; (2) Head -- the head is upright and motionless, with the nose in midline with the body; (3) Arms -- arms bent approximately 120 degrees at the elbow with the wrists resting on the thighs, approximately half way between the hip and the knee; (4) Legs -- legs straight and feet flat on the floor with approximately 90 degree angle at the knees and ankles; (5) Eyes -- eyes closed with smooth eyelids; (6) Mouth -- lips parted in center; (7) Throat — absence of motion; (8) Hands — curled into curved position; (9) Quiet--no vocalizations; (10) Breathing -- breathing rate is less than that observed during baseline, with no interruptions.

Scores for the BRS or Upright Relaxation Scale typically are obtained for each minute of this procedure by observing the subject in the same room for a

Psychophysiological measures.

Heart Rate and Blood Pressure. Subjects' heart rate (HR), systolic blood pressure (SPB), and diastolic blood pressure (DBP) were measured at the specified sampling time points via an automated blood pressure monitor (Criticon Corporation, Tampa, Florida). To conduct these measurements, an inflatable cuff was attached to subjects throughout the experiment. Subjects were instructed to rest quietly during the baseline period, and two heart rate and blood pressure readings were recorded by the monitor during a five minute period in order to establish baseline levels. Additional measurements were recorded by the monitor during the speech preparation period, during the experimental condition period, and during the final measurement period while the subject simultaneously completed the Reactive Irritability Scale (RIS-II). Four heart rate and blood pressure readings were obtained at each of these subsequent time-points.

Biochemical measure.

Salivary cortisol. Subjects were asked to give a saliva sample using a pre-planned script during the baseline and the final stress measurement periods. For each measurement, subjects were given a 14-ml conical-bottom centrifuge tube previously labeled at the 2-ml level with a black marker, and asked to provide enough saliva to fill the tube at least to the black line shown on the tube. After the saliva sample was obtained, the centrifuge tube was placed in a bucket of dry ice until it could be placed in a -80°C freezer for storage. Saliva samples were frozen until assayed, thawed, and then centrifuged and the clear supernatants aspirated for assay. Samples were assayed using a

radioimmunoassy kit (Incstar Corporation, Stillwater, MN). This assay has an accuracy of at least 91% and sensitivity of at least 0.21 µg/dL. Samples were incubated with cortisol tracer in antibody-coated tubes. After incubation, the contents of the tubes were aspirated and the remaining radioactivity in the tubes counted in a gamma-counter. Values were interpolated from a standard curve based on the competitive binding principles of radioimmunoassay. The radioactive counts were converted to concentration (µg/dL) values by Spline function analysis of the standard curve, and then converted to Standard International units (nmol/L) for graphing and analyses by multiplying values by 27.59. Salivary cortisol assays have been used to show changes in cortisol levels in response to stress (Kirschbaum & Hellhammer, 1994).

Psychophysical measure.

Reactive Irritability Scale (RIS-II) Score. The Reactive Irritability Scale [RIS], a psychophysical rating scale in which respondents report their subjective irritability in response to everyday sounds, has been reported to accurately differentiate responses of cigarette smokers who were abstaining from smoking from smokers allowed to smoke and non-smokers (Acri & Grunberg, 1992). Smokers in abstinence rate the everyday sounds as more irritating, and the RIS was reported to be more sensitive to this response than widely-used self-report measures it was compared against (Acri & Grunberg, 1992). The RIS was used in another study to measure environmental stress among workers in an Arctic weather station, and was reported to be as sensitive as biochemical measures of stress and more sensitive than self-report measures (Nespor, Suedfeld, Acri, & Grunberg, 1993). Based on these two studies, it appears that the RIS can

distinguish groups that experience symptoms of stress more accurately than self-report measures, and as accurately as biochemical measures.

Recently, the Reactive Irritability Scale was modified to a shortened, 13-minute version [RIS-II], designed to expedite its clinical use. The RIS-II consists of a recording of eight everyday sounds [see Methods for a detailed list of sounds] played by a cassette tape player and listened to through headphones. Listeners use a response sheet to rate numerically (by magnitude estimation) how irritable they find the everyday sounds compared to a reference sound. Subjects are asked first to rate how irritating they find the reference sound before continuing with the other sounds in order to control for different perceptions of the reference sound itself. The RIS-II differs from the original version by only presenting eight sounds for the listener to rate instead of the original eleven. All instructions and sounds presented on the tape have been professionally recorded on low noise, high density recording tape. The RIS-II provides comparable results to the original version (Brown, Faraday, & Grunberg, 1997). It is noteworthy that the RIS and RIS-II are non-invasive measures of stress that do not increase stress or pain themselves.

In the present study, the RIS-II was presented to each subject via Sony Walkman-type tape player with open air headphones. A pre-set volume level was used to present the ten environmental sound stimuli [two practice sounds, and eight test sounds] at a mean intensity level of 55-75 dB, with peaks of 59-79 dB. Spoken instructions were be delivered at 60-70 dB. Rechargeable batteries were used in the tape player and were recharged after each session in order to minimize variations in power from batteries. In addition, all instructions for this

task were presented on the tape itself in order to minimize any possible variation that might result from experimenter differences in explanations. Printed instructions of the taped instructions were presented on the response form in front of the subject during the entire tape. Subjects were told not to touch the tape player or reposition the headphones once the tape has begun. The RIS -II presents the following eight sounds: horses trotting, a dog barking, an ambulance passing with its siren on, a bugle sounding reveille, a child diving into a pool, a telephone ringing, a fire engine leaving the firehouse and turning its siren on, and a bowling ball being bowled and hitting the pins. The duration of each sound is between twenty and thirty seconds. The bowling ball sound also serves as the reference sound [Please see Appendix I for a copy of the RIS-II Response Sheet].

Independent Variable.

Experimental Condition. **Four experimental conditions** were used in the present experiment. Subjects assigned to the **Progressive Relaxation condition** listened to a taped progressive muscle relaxation exercise. This exercise required subjects to engage in a Progressive Relaxation task while listening to a tape-recorded voice. Subjects assigned to the **Music condition** listened to a taped segment of classical music. This condition required subjects only to listen to music, which has been reported in previous studies to be useful for relaxation. Subjects assigned to the **Attention Control condition** listened to an auditory attention task that required them to pay attention to a tape-recorded voice, and work on a task that required them to focus their attention. This attentional control condition was included in the present experiment in order to

determine if engaging in another activity that is not stress reducing *per se* can also reduce stress. Subjects assigned to the **Silence condition** sat in silence during their break, and did not engage in any physical activities or listen to a tape. This condition was used to determine if the other manipulations resulted in increased or decreased performance on subsequent cognitive performance tasks following the experimental period.

Statistical Analysis Plan

The present experiment used a between-subjects design to examine the effects of two stress management conditions and two control conditions on levels of attention, relaxation, and stress responses of healthy, adult males. Scatter-plot data was examined to determine if outlier data existed. Where outliers did exist (defined as more than two standard deviations away from the group mean), data were analyzed with and without outlier data. If the presence of outliers did not change the results, then outlier data were left in the data set. Using this procedure, only one outlier data point was removed. One data point was removed from the Silence group of the cortisol data because the value was beyond five standard deviations from the mean value of the group, suggesting that an experimental error occurred with this sample during the cortisol assay. Statistical significance for all analyses was based on two-tailed distributions with an alpha level of 0.05. Tukey's HSD post-hoc test, a moderately conservative test (Keppel, 1994), was used to examine group differences, when appropriate.

Sample Characteristics. Sample characteristics, including demographics, speech anxiety, positive and negative affect, perceived stress, and psychological distress levels were examined using chi-square analyses to determine if group

differences existed at baseline. An independent means t-test was used to determine if group mean levels of perceived stress differed from a population normative value. Musical preference was correlated with other self-report, behavioral, psycophysiological, and biochemical measurements obtained during the experimental period to determine whether subjects responded differentially based upon their preference to the classical music selection that was used.

Behavioral Measures of Attention. For the letter cancellation task, group means for speed of completion, number of errors, and "through-put" were examined. The through-put variable was computed by converting the number of errors each subject committed during the time they required to complete the task into an error per minute rate. Then, each of these variables was examined using a repeated-measure ANOVA over the three time-points this task was administered. Individual ANOVAs were then used to examine between-group differences at baseline, after the stress manipulation period, and after the experimental period. Paired t-tests were used to determine within-group differences on speed and accuracy, pairing the baseline and post-stress manipulation administrations, and post-stress manipulation and experimental period administrations. For the first two computerized PAB tasks, responses to the first 25 and second 25 trials were examined separately to control for learning effects on each of these tasks. Group means for speed to complete each of the first 25 trials and each of the second 25 trials were computed as well as total number of errors on the first 25 and second 25 trials. A MANOVA was used to examine between-group differences for each of these variables at baseline and at the experimental period measurement point. For the third PAB task, group

means for accuracy and time to complete the ten trials at baseline and following the experimental period were compared.

Self-Report Measures of Attention. Repeated-measure ANOVAs were used to examine group means of Visual Analog Scale (VAS) responses obtained at four time-points. Follow-up ANOVAs were conducted to examine between-group differences at each time point for the item measuring attention/distraction, and follow-up MANOVAs were similarly used to examine between-group differences at each time-point for the two items measuring attentional focus. Paired t-tests were used to examine within-group differences following the stress manipulation, the experimental period, and during the final stress measurement period. Focus of Attention questionnaire (FAQ) data was examined using an overall ANOVA to examine differences on between-group means, and t-tests to examine within-group means differences on the internal and external subscales.

Behavioral Measure of Relaxation. An overall ANOVA was used to examine between-group differences on mean total scores of the Upright Relaxation Scale (URS).

Self-Report Measures of Relaxation. Repeated-measure ANOVAs were used to examine group means on Visual Analog Scale (VAS) and Profile of Mood States (POMS-SF) subscale responses obtained at four time-points. Follow-up ANOVAs were conducted to examine between-group differences at each time point for the VAS item measuring relaxation/tension and the tension subscale of the POMS-SF, and t-tests were used to examine within-group differences between the stress manipulation period and the experimental period on these two measures.

Self-Report Measures Indexing Stress. Repeated-measure ANOVAs were used to examine group means on the vigor subscale and the fatigue subscale of the Profile of Mood States (POMS-SF), obtained at four time-points. Follow-up ANOVAs were conducted to examine between-group differences at each time-point, and t-tests were used to examine within-group differences between the stress manipulation period and the experimental period on these two measures. Between-group means on the Cognitive and Somatic Anxiety Questionnaire (CSAQ) were examined using an overall MANOVA, and t-tests were conducted to examine within-group differences on the cognitive and somatic subscales.

Psychophysiological Measures Indexing Stress. Repeated-measures ANOVAs were used to examine group mean differences on heart rate, systolic blood pressure, diastolic blood pressure, and mean arterial pressure measurements obtained at four time-points. Follow-up ANOVAs were conducted to examine between-group differences at each time-point, and t-tests were conducted to examine within-group differences at each time-point.

Biochemical Measure Indexing Stress. An overall ANOVA was conducted to examine baseline differences on group mean salivary cortisol concentrations. Baseline differences were used as a covariate in a subsequent ANOVA conducted to examine group differences in salivary cortisol concentrations obtained from samples collected during the final stress measurement period. Paired t-tests were used to examine within-group differences of baseline and final stress measurement salivary cortisol concentrations.

Psychophysical Measure Indexing Stress. Group differences on median

magnitude estimate values for each RIS-II stimulus were examined using a Kruskal-Wallis test, following procedures used by previous investigators (e.g., Acri & Grunberg, 1992). In addition, slopes of the group median magnitude estimates were calculated, and t-tests were used to compare the slopes according to procedures described in Cohen and Cohen (1983).

RESULTS

Sample Characteristics

Demographics. Table 3 presents demographic information for each experimental group. Tables 4a through 4f present group means and results from data analyses. There were no differences among groups revealed in analyses of any of the demographic variable measured.

Speech Anxiety. Table 5 presents group means for speech anxiety as derived from tertile assignment of subjects based upon their total Personal Report of Communication Apprehension (PRCA) subscale scores obtained during telephone screening, and results from the data analysis. There was no difference among groups.

Positive and Negative Affect. Table 6 presents group means for positive and negative affect as measured during baseline using the Positive and Negative Affect Schedule (PANAS), and results from the data analyses. These values are within one standard deviation of published norms (Watson, et al., 1988). An ANOVA revealed a group difference for negative affect [$F(3, 63) = 3.352$, $p < 0.05$], however a post-hoc test failed to find differences between groups.

Perceived Stress. Table 7 presents group means for perceived stress during the past month as measured by the Perceived Stress Scale (PSS), and the F-value from the data analysis. There was no difference among groups. In addition, there was no difference between the group mean values measured in the present sample of men and the published value for men from a nationwide survey (Cohen &Williamson, 1988).

Psychological Distress. Table 8 presents group means for psychological distress during the past two weeks as measured by the Brief Symptom Inventory (BSI). These values are within one standard deviation of published values for non-patients (Derogatis, & Melisaratos, 1983). Table 8 also presents results from the data analyses. There were no differences among groups on the total score, or scores on the anxiety, depression, hostility, psychotic, and somatic subscales.

Time of Day. Table 9 presents group means for time of day that subjects participated in the experiment based upon quasi-random assignment during telephone screening, and the F-value from the data analysis. There was no difference between groups.

Music Preference. Table 10 presents group means for data that were collected regarding musical preference and the results of data analyses. There was no difference among groups. Table 11 presents the results of correlations between music preference ratings and other self-report, behavioral, psychophysiological, and biochemical measurements obtained during the experiment. Preference for classical was positively correlated with how much subjects listened to classical music [$r = .607$, $p < 0.05$]. No other significant correlations were revealed.

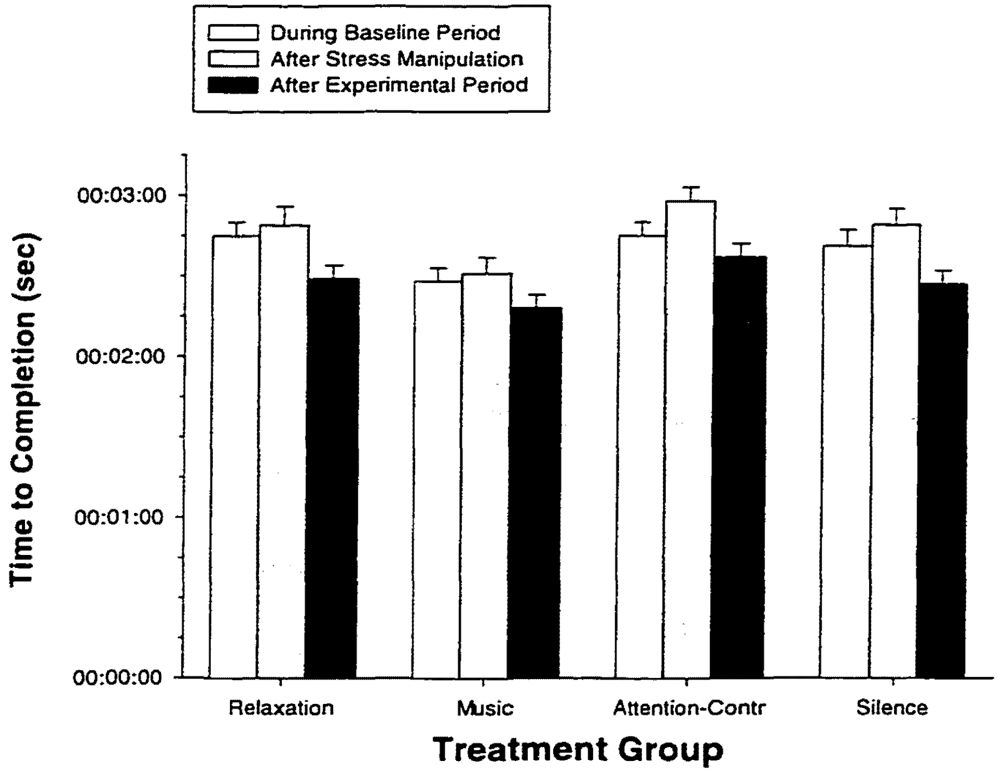

Figure 1: Time to complete Digit Vigilance Task (sec) by experimental group.

Behavioral Measures of Attention

Letter Cancellation task (DVT). Figure 1 presents mean completion times of experimental groups on the letter cancellation task administered at baseline, after the stress manipulation, and after the experimental period. Table 12 presents group means, and Table 13 presents results from the data analyses. There were no differences among groups on mean completion times at baseline. There was a significant difference among groups revealed for mean completion time of this task after the stress manipulation [$F(3, 62) = 3.133$, $p < 0.05$]. A post-hoc test revealed that the Music group completed this task faster than the Attention Control group. There were no differences among groups on mean completion times after the experimental period. All four experimental groups completed the letter cancellation task significantly faster on the third administration following the experimental period compared to the second

administration following the stress manipulation [Progressive Relaxation: $t_{(15)}$ = 5.351; Music: $t_{(15)}$ = 6.007; Attention Control: $t_{(16)}$ = 7.175; Silence Condition: $t_{(15)}$ = 10.966].

Figure 2 presents mean number of errors committed by experimental groups on the letter cancellation task administered at baseline, after the stress manipulation, and after the experimental period. Table 12 presents group means, and Table 13 presents results from the data analyses. There were no

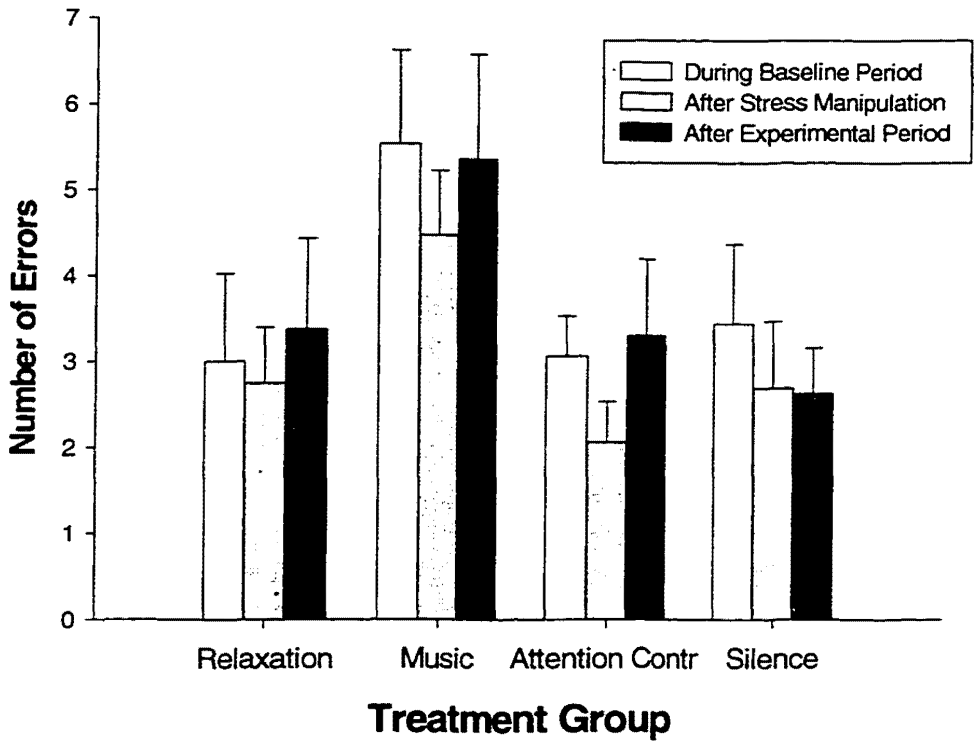

Figure 2: Number of errors committed on Digit Vigilance Task by experimental group.

differences among groups on mean number of errors committed during baseline, after the stress manipulation period, and after the experimental period. No significant changes within groups were revealed when comparing group means of errors committed during the second and third administrations of this task.

Figure 3 presents mean through-put rates (errors per minute) by experimental groups on the letter cancellation task administered at the three timepoints described above. Table 12 presents group means, and Table 13 presents results from the data analyses. There was no significant difference among groups on their rate of errors per minute during the baseline period or after the experimental period. A significant difference among groups was revealed for through-put after the stress manipulation period [$F(3, 62) = 3.332$, p

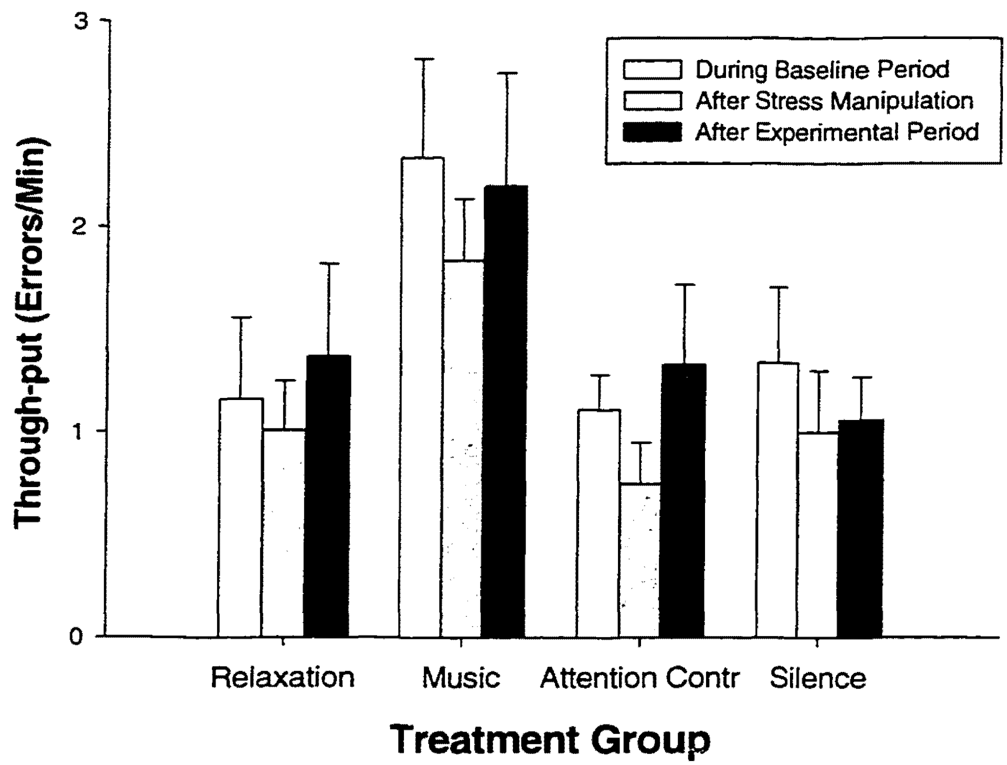

Figure 3: Through-put (errors/min) on Digit Vigilance Task by experimental group.

< 0.05]. A post-hoc test revealed that the Music group committed more errors per minute than the Attention Control group. No significant differences were revealed within groups on this variable when comparing through-put after the stress manipulation period to after the experimental period.

PAB Task 1 (Choice Reaction). Figure 4 presents mean reaction times of

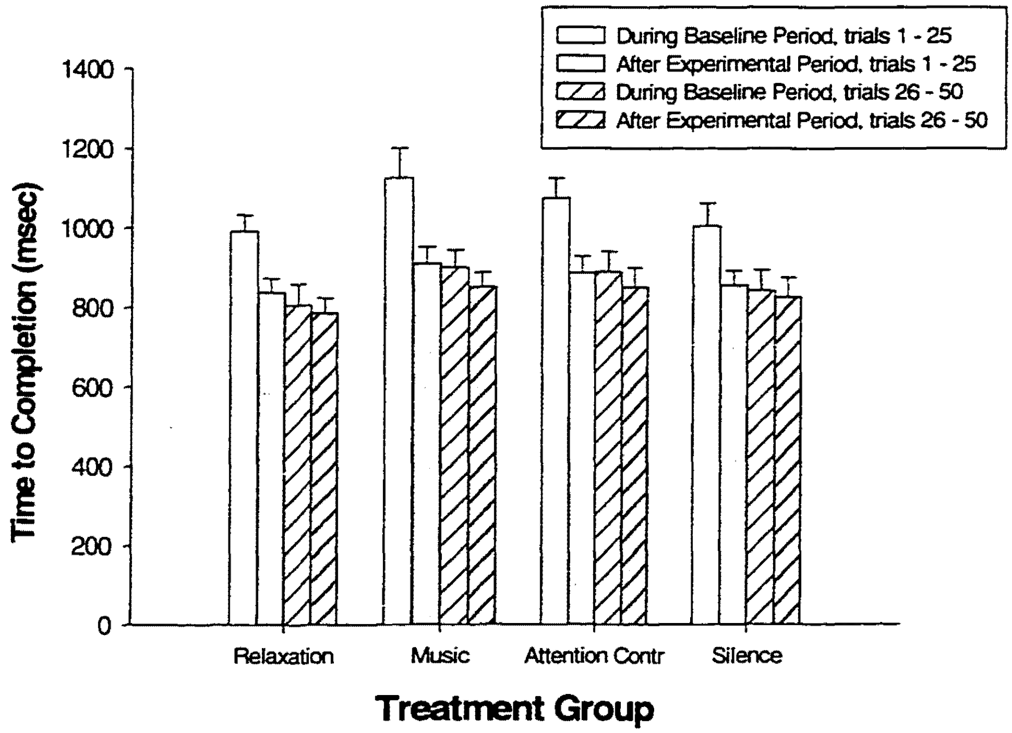

Figure 4. Time to complete Performance Assessment Battery (PAB) Choice Reaction Time task (msec) by experimental group.

experimental groups on the first computer task. Table 14 presents group means and Table 15 presents results from the data analyses. There were no differences among groups on mean response times to the first 25 trials, or the second 25 trials presented at baseline. There were no differences among groups on mean response times to the first 25 trials, or the second 25 trials presented after the experimental period. Only the Music group had a significantly improved reaction time from the first to the second administration [$t_{(17)} = 2.455$] when comparing reaction times of the experimental groups on the 25 second-half trials.

Figure 5 presents mean number of errors committed by experimental groups on the first computer task. Table 14 presents group means and Table 15 presents results from the data analyses. There were no differences among

groups on mean number of errors committed during the first 25 trials, or the second 25 trials presented at baseline. There were no differences among groups on mean number of errors committed during the first 25 trials, or the second 25 trials presented after the experimental period. No significant changes were revealed on group means of errors committed from the first to the second administration of this task when examining the 25 second-half trials.

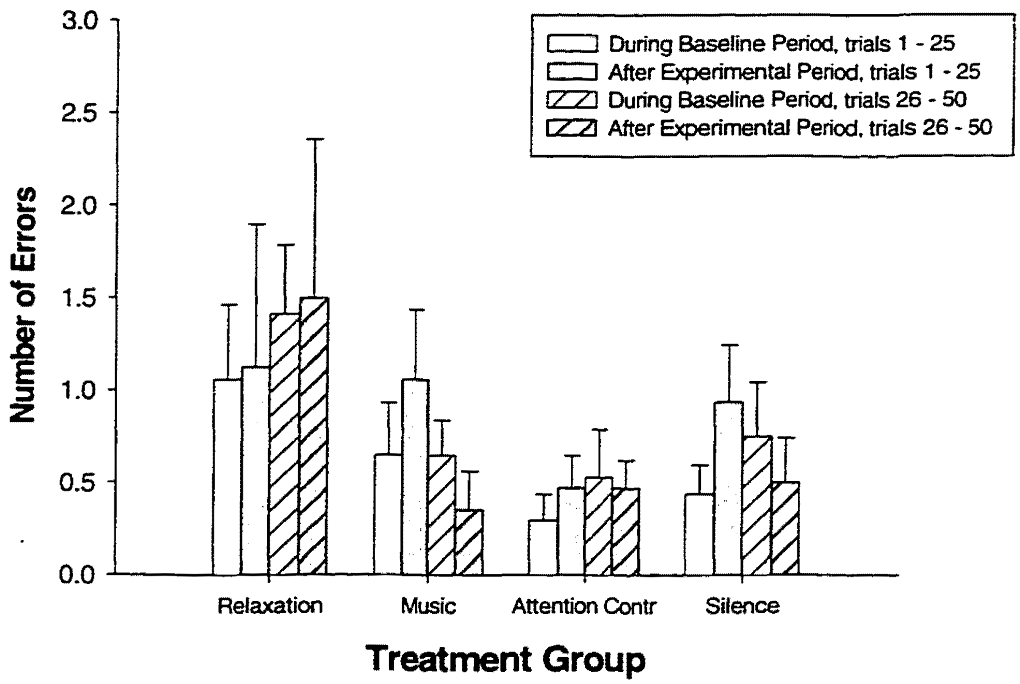

Figure 5. Number of errors committed during Performance Assessment Battery (PAB) Choice Reaction Time task by experimental group.

PAB Task 2 (Serial Addition-Subtraction). Figure 6 presents mean reaction times of experimental groups on the second computer task. Table 16 presents group means and Table 17 presents results from the data analyses. There were no differences among groups on mean response times to the first 25 trials, or the second 25 trials presented at baseline. There were no differences

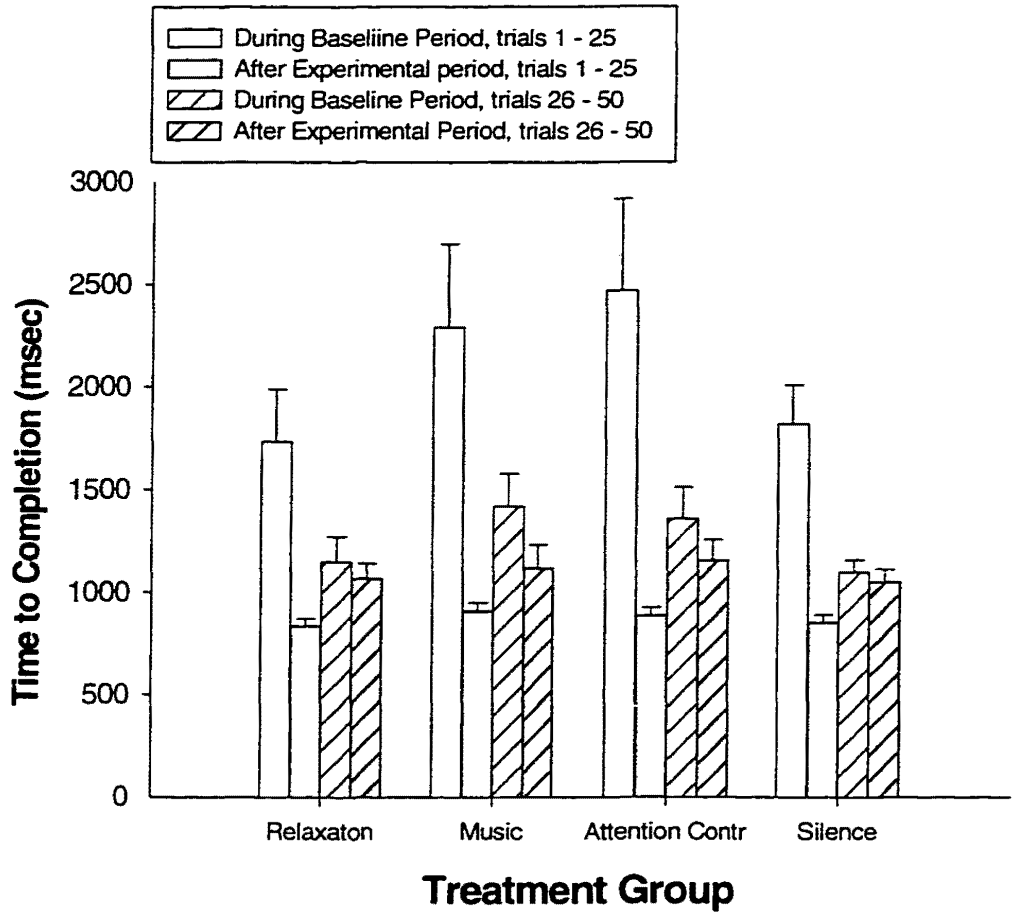

Figure 6. Time to complete Performance Assessment Battery (PAB) Serial Addition-Subtraction task (msec) by experimental group.

among groups on mean response times to the first 25 trials or the second 25 trials presented after the experimental period. All four experimental groups had faster reaction times on the 25 second-half trials from the first to the second administration [Progressive Relaxation: $t_{(14)} = 3.553$; Music: $t_{(14)} = 2.169$; Attention Control: $t_{(15)} = 2.729$; Silence Condition: $t_{(15)} = 4.005$].

Figure 7 presents mean number of errors committed by experimental groups on the second computer task presented at baseline and after the experimental period. Table 16 presents group means and Table 17 presents results from the data analyses. There were no differences among groups on mean number of errors committed during the first 25 trials or the second 25 trials presented at baseline. There were no differences among groups on mean

number of errors committed during the first 25 trials or the second 25 trials presented after the experimental period. The Music group [$t_{(14)} = 3.227$], Attention Control group [$t_{(15)} = 3.903$], and Silence condition [$t_{(15)} = 2.481$] made significantly more errors during the second administration of this task when comparing only the 25 second-half trials.

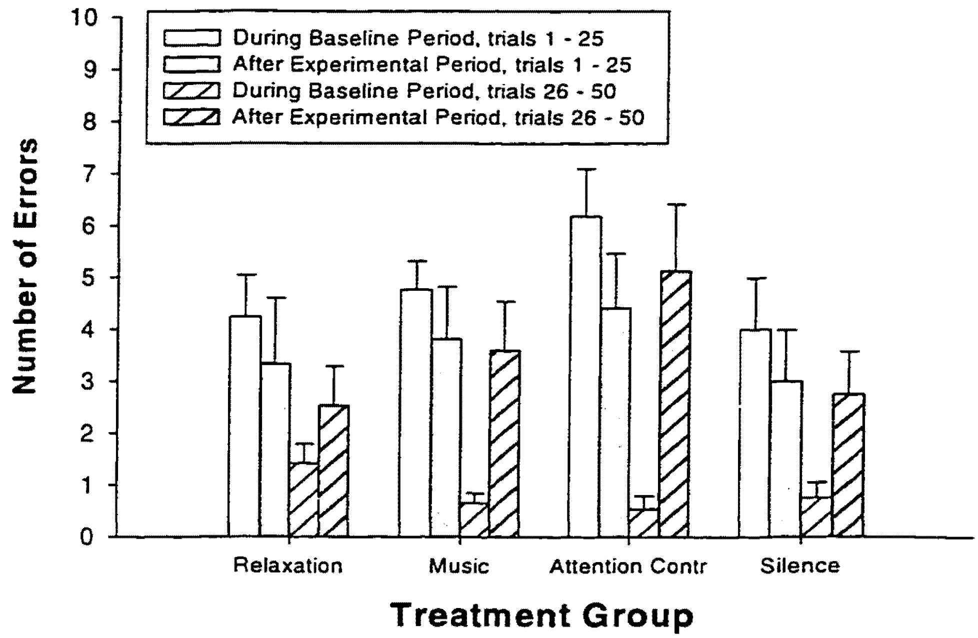

Figure 7. Number of errors committed completing Performance Assessment Battery (PAB) Serial Addition-Subtraction task by experimental group.

<u>PAB Task 3 (Six-Letter Search)</u>. Figure 8 presents mean reaction times of experimental groups on the third computer task presented at baseline and after the experimental period. Table 18 presents group means and Table 19 presents results from the data analyses. There were no differences among groups on mean response times to the ten trials presented at baseline, or after the experimental period. No significant changes on mean reaction times were revealed among the experimental groups from the first to the second administration of this task.

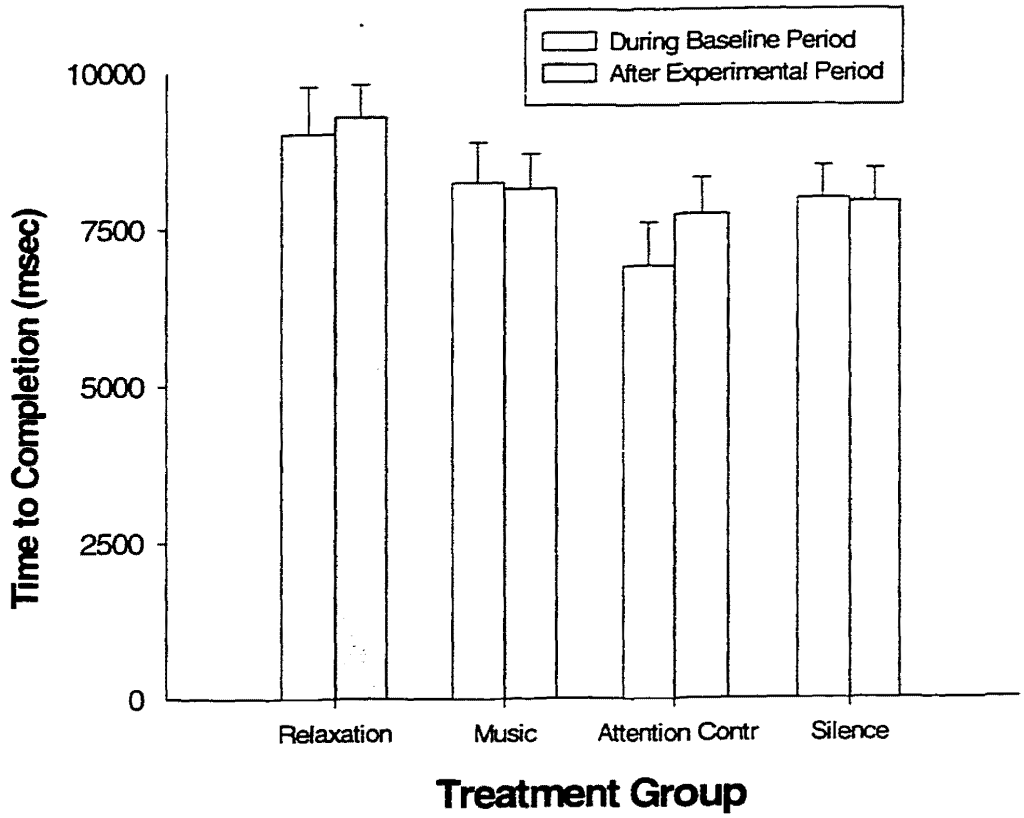

Figure 8. Time to complete Performance Assessment Battery (PAB) Six-Letter Search task (msec) by experimental group.

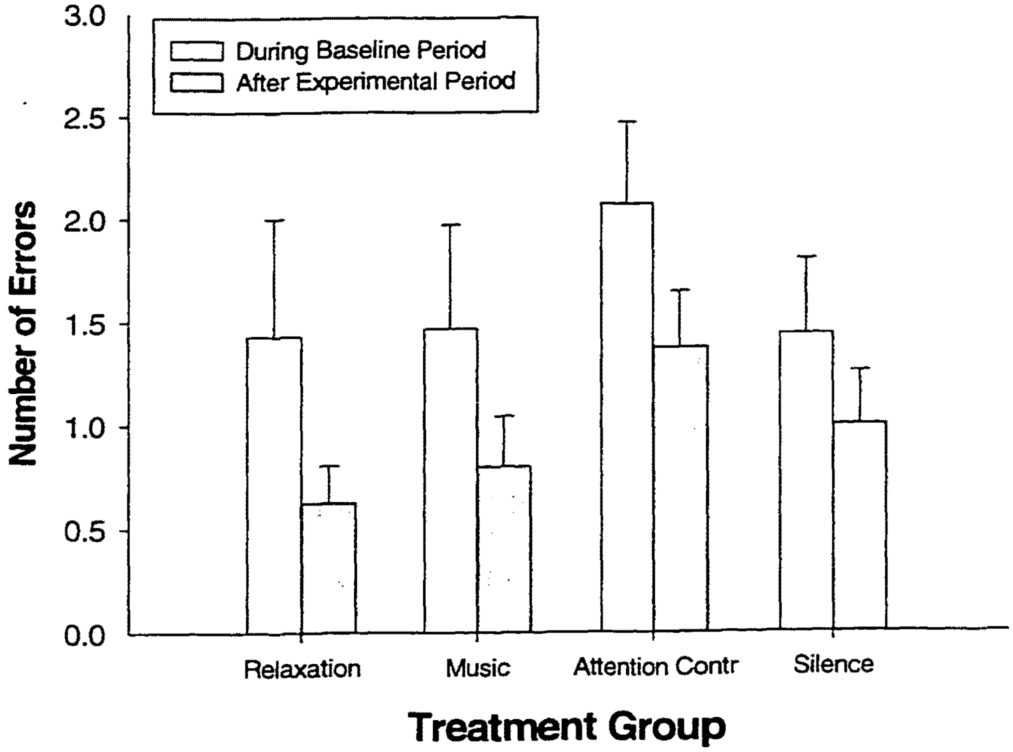

Figure 9. Number of errors committed during Performance Assessment Battery (PAB) Six-Letter Search task by experimental group.

Figure 9 presents mean number of errors committed by experimental groups on the third computer task presented at baseline and after the experimental period. Table 18 presents group means and Table 19 presents results from the data analyses. There were no differences among groups on mean number of errors committed during the ten trials presented at baseline, or after the experimental period. There were no significant changes revealed among groups when examining group means of errors from the first to the second administration of this task

Self-Report Measures of Attention

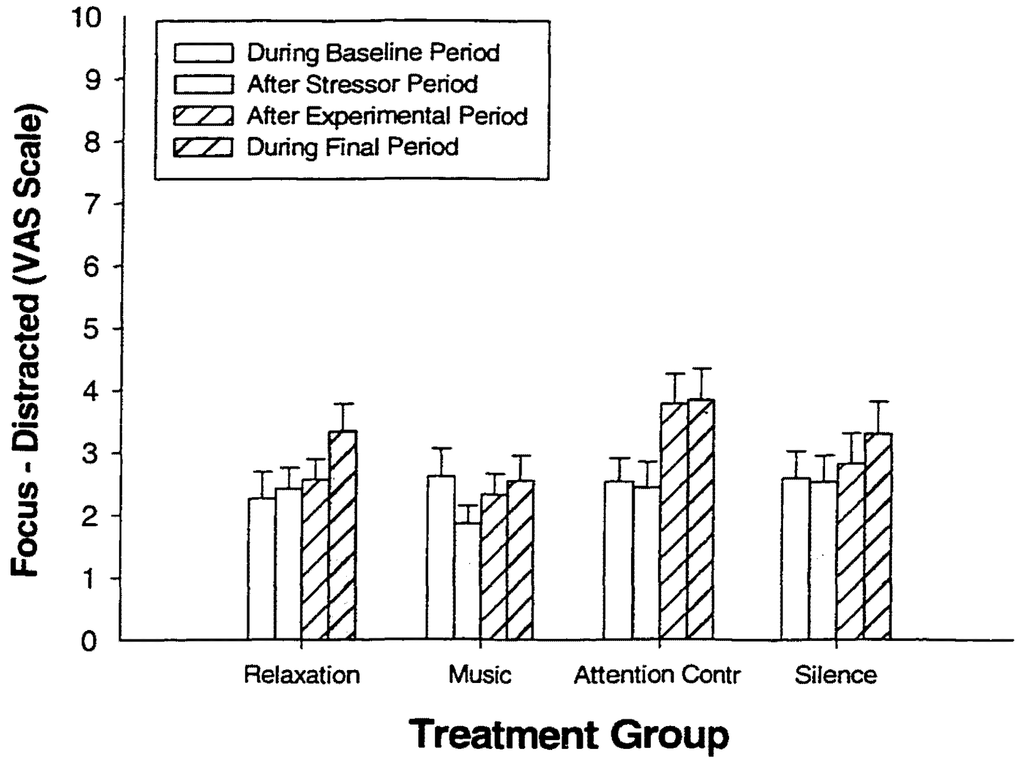

Figure 10. Visual analog scale (VAS) scores measuring self-reported attention during experiment (0 = extremely focused, 10 = extremely distracted).

Visual Analog Scale (VAS) Items. Figure 10 presents group mean scores of the VAS item that was designed to measure the degree subjects were focused

or distracted, which was administered at baseline, after the stress manipulation period, after the experimental period, and during the final stress measurement period. Table 20 presents group means and Table 21 presents results from the data analyses. There were no significant differences among groups on responses to this VAS item after baseline, after the stress manipulation period, after the experimental period, and during the final stress measurement period. The Music group [$t_{(16)} = 2.441$], and the Attention Control group [$t_{(16)} = 2.671$] reported being significantly more distracted when measured at the end of the experimental period compared to the end of the stress manipulation period.

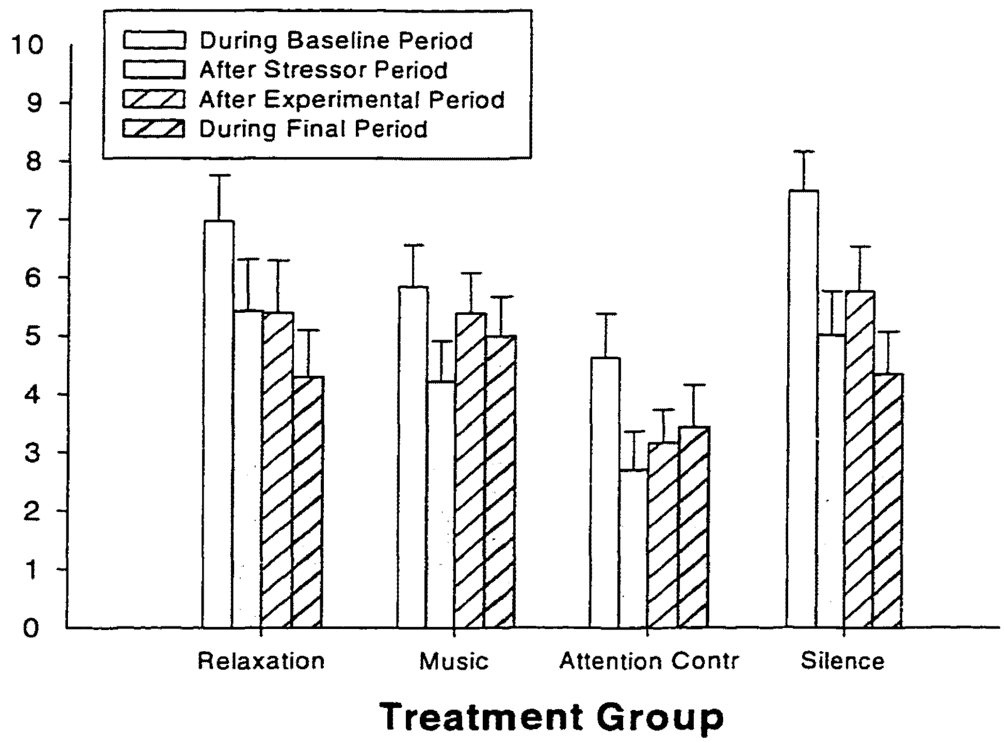

Figure 11. Visual analog scale (VAS) scores measuring self-reported thoughts of next task during experiment (0 = Thinking a lot about the next task, 10 = Not thinking at all about the next task).

Figure 11 presents group mean scores of the VAS item that was designed to measure the degree subjects were thinking about the next task, which also

was administered at baseline, after the stress manipulation period, after the experimental period, and during the final stress measurement period. Table 22 presents group means and Table 23 presents results from the data analyses. There was a significant difference among the experimental groups on this VAS item at baseline [$F(3, 63) = 2.971$, $p < 0.05$]. A post-hoc test revealed that subjects in the Attention Control group were thinking more about the next task at baseline than subjects in the Silence Condition. There were no significant differences among groups on this VAS item after the stress manipulation period, after the experimental period, and during the final stress measurement period. Three experimental groups reported thinking more about the next task when measured after the stress manipulation period compared to when they were measured at baseline [Music: $t_{(16)} = 2.532$; Attention Control: $t_{(16)} = 3.054$; Silence Condition: $t_{(15)} = 2.971$].

Figure 12 presents group mean scores of the VAS item that was designed to measure the degree to which subjects were thinking about how they were doing, and was administered at the same time as the previous two items. Table 24 presents group means and Table 25 presents results from the data analyses. There were no differences among experimental groups on responses to this item when measured at baseline, however there was a significant difference among the groups on this item when measured after the stress manipulation period [$F(3, 63) = 3.551$, $p < 0.05$]. A post-hoc test revealed that subjects in the Attention Control group were thinking more about how they were doing at that time point than subjects in the Silence Condition. There were no significant differences among groups on this item after the experimental period, and during the final

stress measurement period.

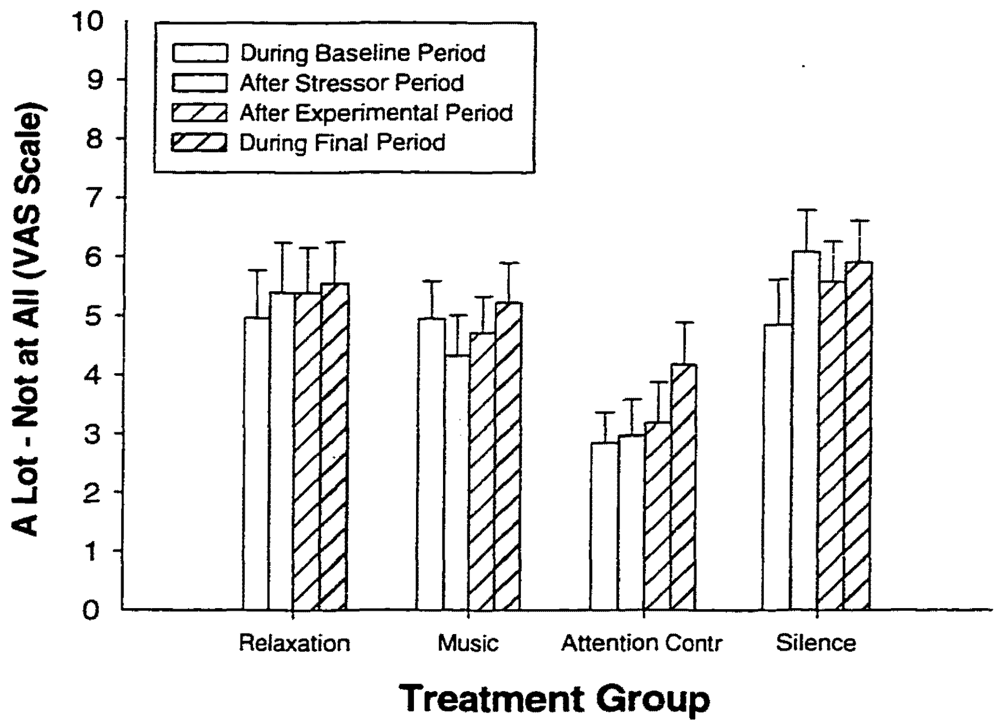

Figure 12. Visual analog scale (VAS) scores measuring self-reported thoughts about self during experiment (0 = Thinking a lot about how I am doing, 10 = Not thinking at all about how I am doing).

Focus of Attention. Table 26 presents group mean scores of the internal and external subscales of the Focus of Attention Questionnaire (FAQ), and results from the data analyses. There were no significant differences among experimental groups for either the internal or external subscales. All four groups reported that they were significantly more externally than internally focused [Progressive Relaxation: $t_{(16)} = 3.291$; Music: $t_{(16)} = 4.978$; Attention Control: $t_{(16)} = 3.573$; Silence Condition: $t_{(15)} = 3.918$].

Behavioral Measure of Relaxation

Upright Relaxation Scale (URS). Figure 13 presents mean scores of the

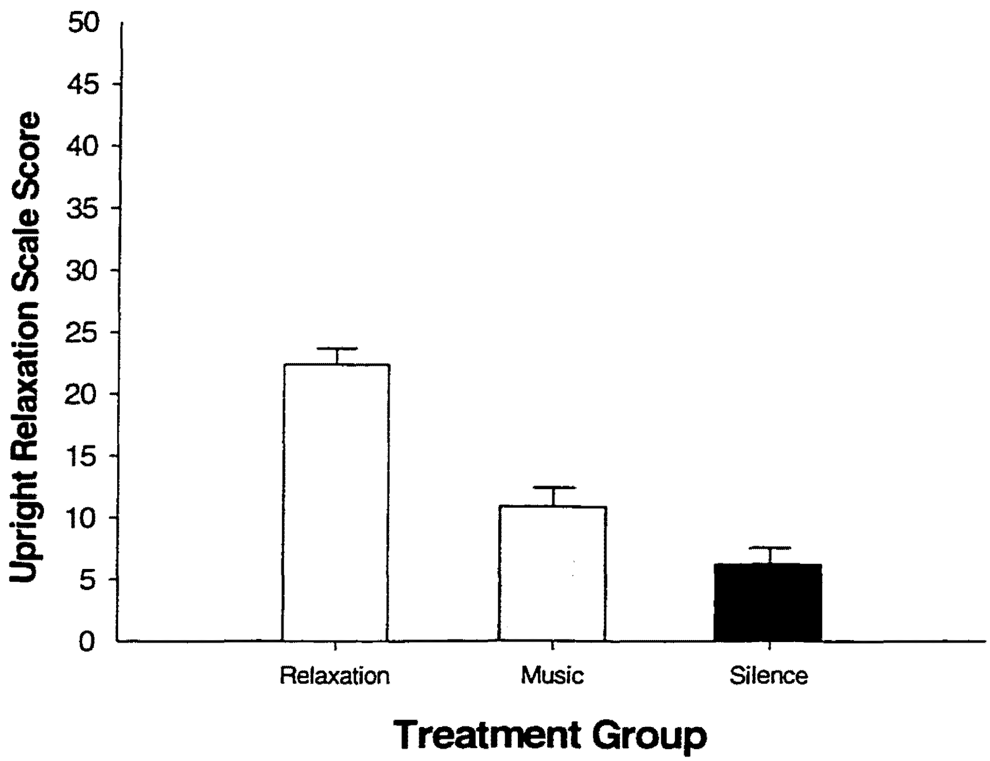

Figure 13. Upright Relaxation Scale (URS) behavioral relaxation measurements obtained during the experimental phase for the relaxation, music, and silence groups.

three experimental groups that were measured on eight relaxation postures of the Upright Relaxation Scale procedure during the experimental period. There was a significant difference among groups revealed for mean total scores obtained from this measurement [$F(2, 47) = 35.588$, $p < 0.05$]. A post-hoc test revealed that subjects in the Progressive Relaxation group exhibited more of the postures indicating relaxation than both the Music and the Silence Condition groups, and the Music group exhibited more relaxation behaviors than the Silence Condition group (the Attention Control group was not measured).

Self-Report Measures of Relaxation

Visual Analog Scale (VAS) Item. Figure 14 presents group mean scores of the VAS item that was designed to measure the degree subjects were tense or relaxed, which was administered at baseline, after the stress manipulation

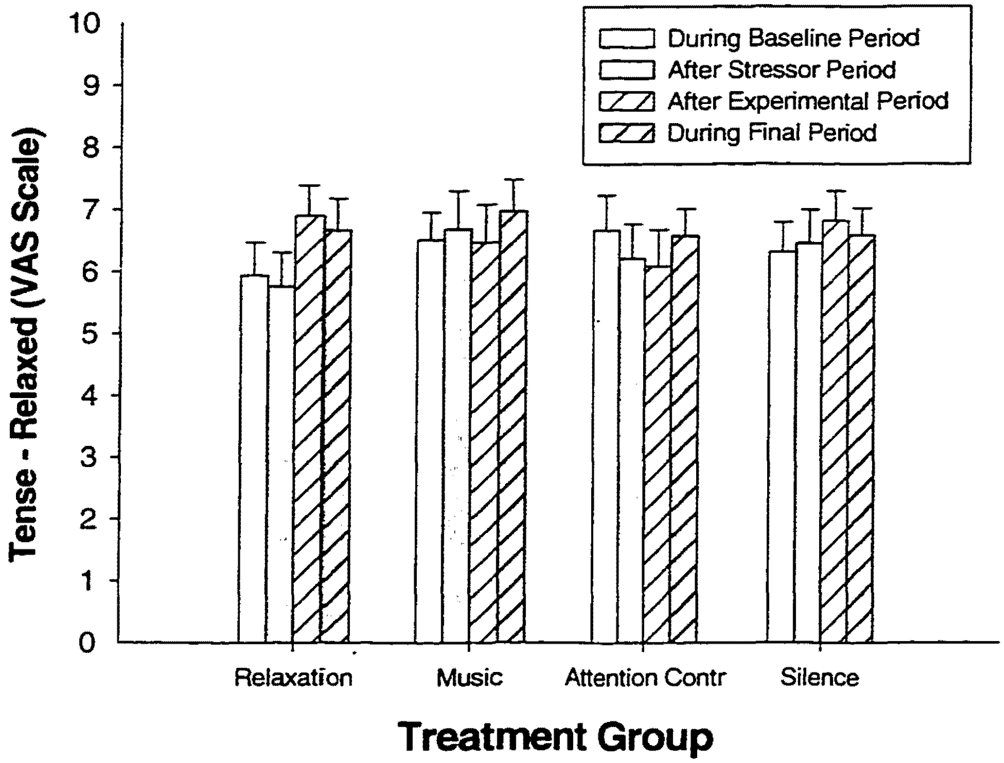

Figure 14. Visual analog scale (VAS) scores measuring self-reported relaxation during experiment (0 = Very Tense, 10 = Very Relaxed).

period, after the experimental period, and during the final stress measurement period. Table 27 presents group means and Table 28 presents results from the data analyses. There were no significant differences among groups on this VAS item after baseline, after the stress manipulation period, after the experimental period, and during the final stress measurement period. The Progressive Relaxation group reported being significantly more relaxed when measured at the end of the experimental period compared to the end of the stress manipulation period [$t_{(16)} = -2.915$].

Profile of Mood States (POMS-SF) Tension subscale. Figure 15 presents group mean scores of the tension subscale from the POMS-SF, which was administered at baseline, after the stress manipulation period, after the experimental period, and during the final stress measurement period. Table 29

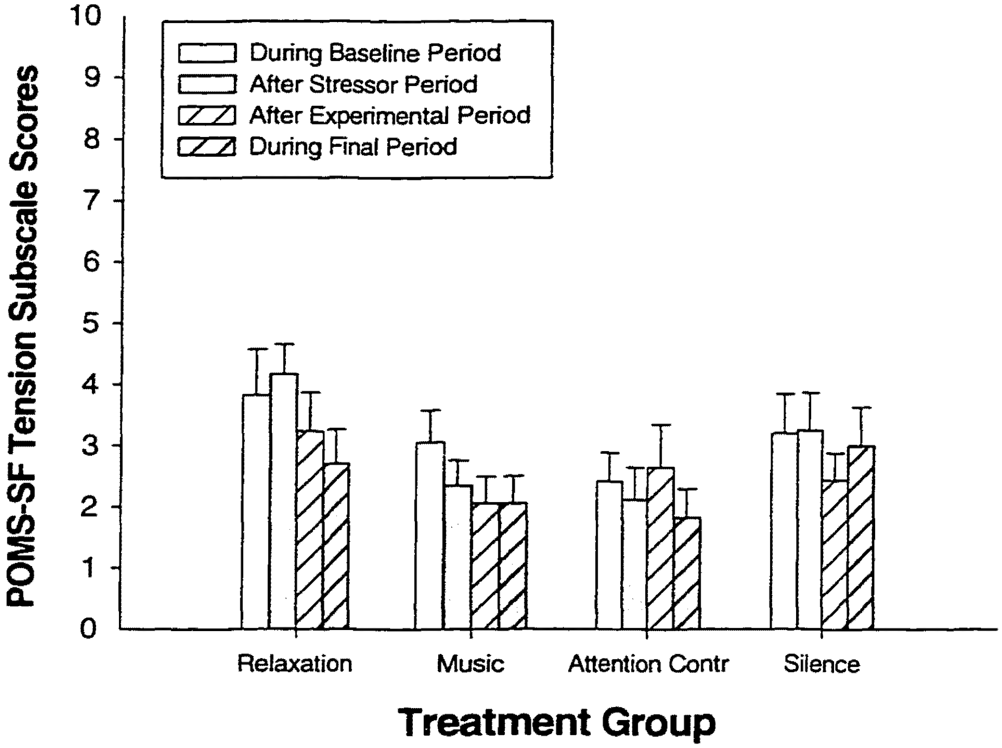

Figure 15. Profile of Mood States, Short Form (POMS-SF) subscale scores measuring self-reported tension during experiment.

presents group means and Table 30 presents results from the data analyses. There were no difference among groups on responses to this subscale during the baseline period.. However, there was a significant difference among groups revealed for mean scores on this subscale when it was measured after the stress manipulation period [$F(3, 63) = 3.421$, $p < 0.05$]. A post-hoc test revealed that subjects in the Progressive Relaxation group reported themselves to be more tense than subjects in the Attention Control group. There were no differences among groups when measured after the experimental period, and during the final stress measurement period. The Progressive Relaxation group reported

being significantly less tense when measured at the end of the experimental period compared to the end of the stress manipulation period [$t_{(16)} = 2.175$].

Self-Report Measures Indexing Stress

Profile of Mood States (POMS-SF) Vigor subscale. Figure 16 presents group mean scores of the vigor subscale from the POMS-SF, which was administered at baseline, after the stress manipulation period, after the experimental period, and during the final stress measurement period. Table 31

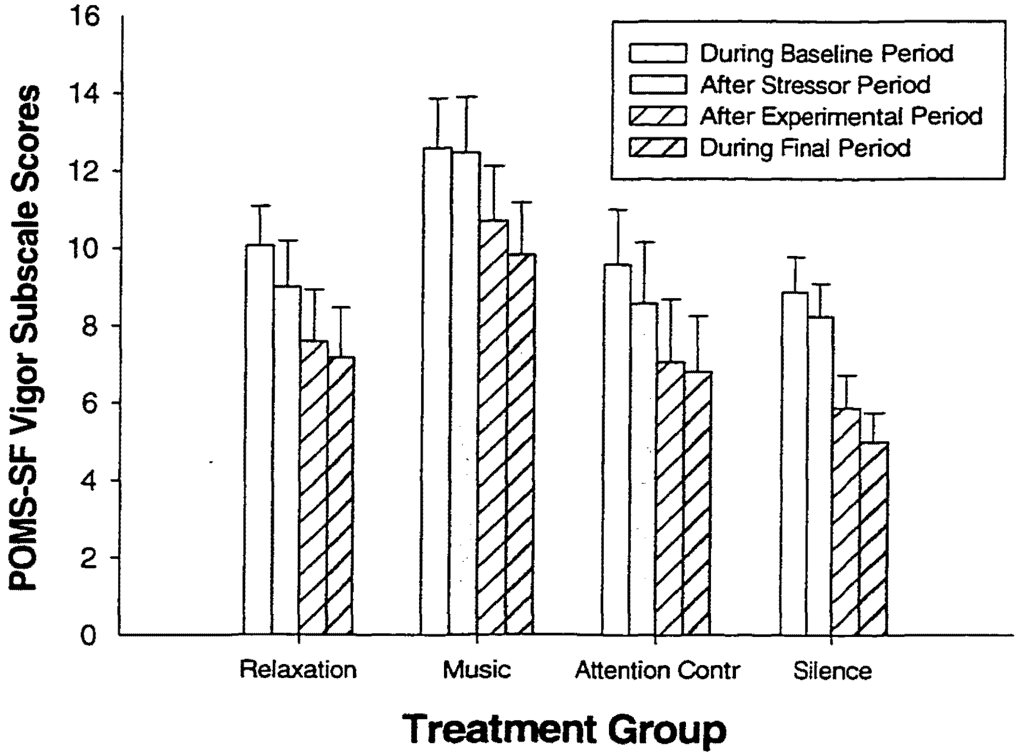

Figure 16. Profile of Mood States, Short Form (POMS-SF) subscale scores measuring self-reported vigor during experiment.

presents group means and Table 32 presents results from the data analyses. There were no difference among groups on responses to this subscale during the baseline period, after the stress manipulation period, after the experimental period, and during the final stress measurement period. The Music group, the

Attention Control group, and Silence Condition group all reported being significantly less vigorous when measured at the end of the experimental period compared to the end of the stress manipulation period [Music group: $t_{(16)} = 2.985$; Attention Control group: $t_{(16)} = 2.177$; Silence Condition: $t_{(15)} = 2.911$].

Profile of Mood States (POMS-SF) Fatigue subscale. Figure 17 presents group mean scores of the POMS-SF Fatigue subscale, which were obtained at the same time-points described above. Table 33 presents group means and

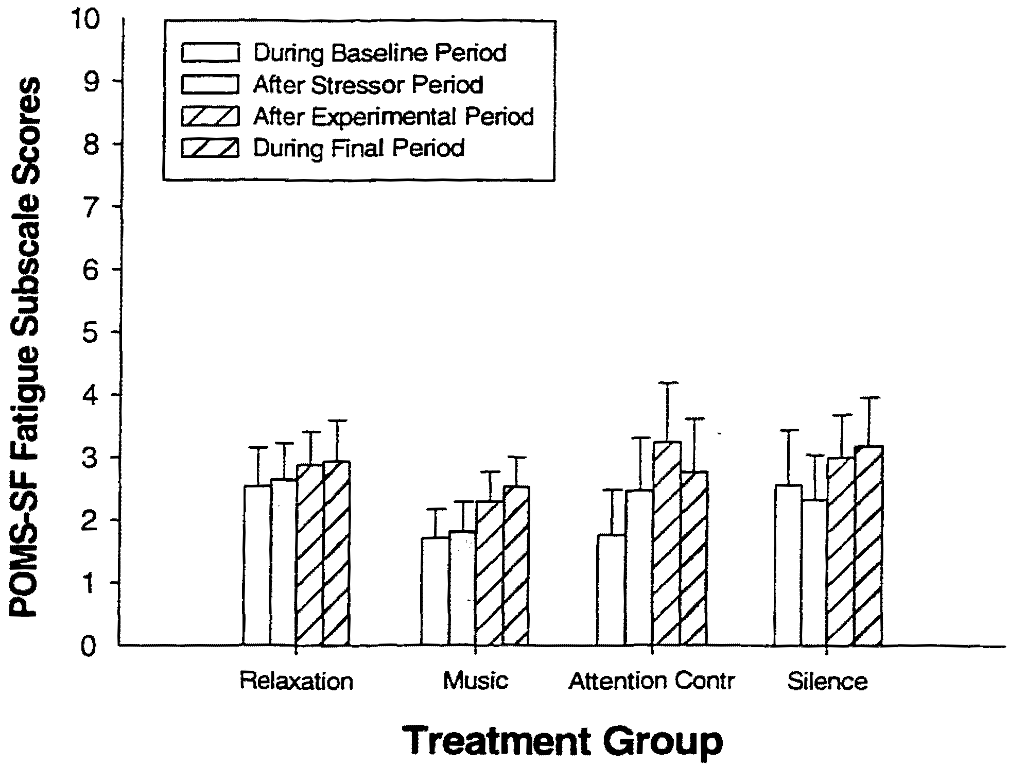

Figure 17. Profile of Mood States, Short Form (POMS-SF) subscale scores measuring self-reported fatigue during experiment.

Table 34 presents results from the data analyses. There were no differences among groups on responses to this subscale during the baseline period, after the stress manipulation period, after the experimental period, and during the final stress measurement period. All four groups reported equivalent levels of fatigue when comparing their mean scores at baseline to their mean scores during the

final stress measurement period [Progressive Relaxation group: $t_{(16)} = 0.835$, n.s.; Music group: $t_{(16)} = 1.533$ n.s.; Attention Control group: $t_{(16)} = 1.617$, n.s.; Silence Condition: $t_{(15)} = 0.696$, n.s.].

Cognitive and Somatic Anxiety Questionnaire (CSAQ). Table 35 presents group mean scores of the cognitive and somatic subscales of the CSAQ, and F-values from data analyses. A significant differences among groups was revealed for the cognitive subscale [$F(3, 63) = 3.062$, $p < 0.05$], however a post-hoc test failed to find differences among groups. There was no difference among groups on the somatic subscale. None of the groups reported being more cognitively or somatically focused [Progressive Relaxation: $t_{(16)} = 1.029$; Music: $t_{(16)} = 0.117$; Attention Control: $t_{(16)} = -0.910$; Silence Condition: $t_{(15)} = 0.816$].

Psychophysiological Measure Indexing Stress

Heart Rate. Figure 18 presents group mean heart rate levels, which were measured at baseline, during the stress manipulation period, during the experimental period, and during the final stress measurement period. Table 36 presents group means and Table 37 presents results from the data analyses. There was no difference among groups at baseline, during the stress manipulation period, and during the final stress measurement period. However, there was a significant difference among groups revealed for mean heart rate levels during the experimental period [$F(3, 63) = 3.574$, $p < 0.05$]. A post-hoc test revealed that subjects in the Music group had lower heart rates than subjects in the Attention Control group. Comparisons of heart rate levels at each time point revealed that all groups had significantly higher heart rates during the stress manipulation period compared to baseline [Progressive Relaxation: $t_{(16)} =$

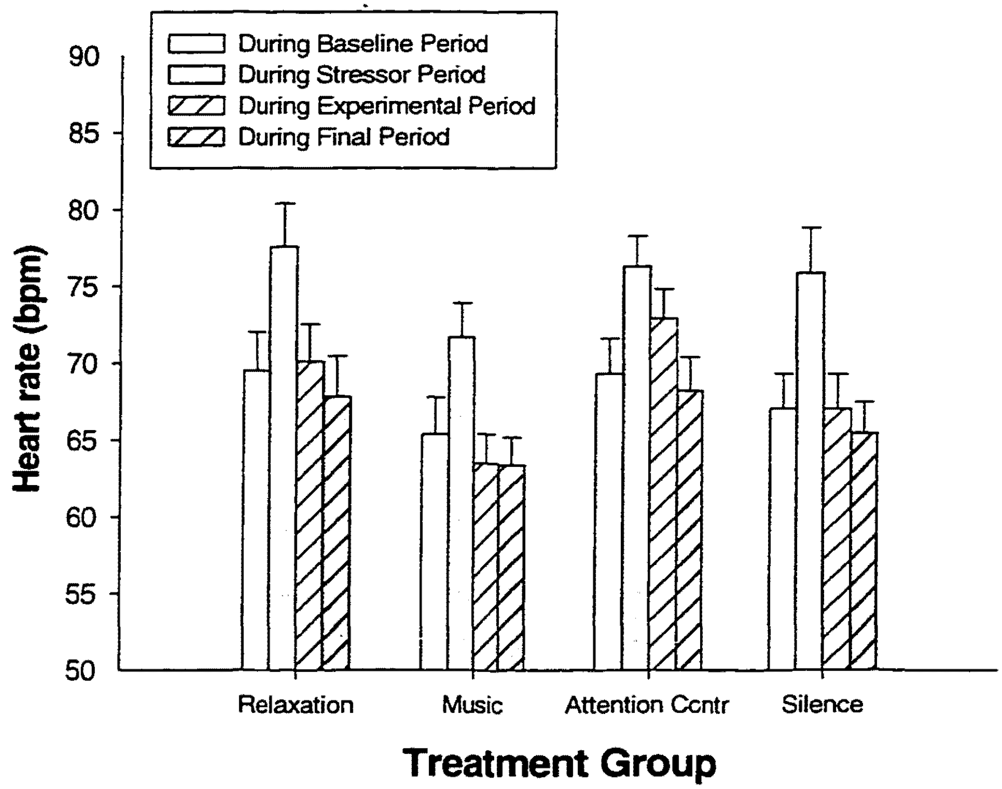

Figure 18. Heart rate measurements (bpm) obtained during each phase of the experiment for each experimental group.

4.971; Music: $t_{(15)} = 4.169$; Attention Control: $t_{(16)} = 5.162$; Silence Condition: $t_{(14)} = 4.317$], and all groups had significantly lower heart rates during the experimental period compared to the stress manipulation period [Progressive Relaxation: $t_{(16)} = 6.561$; Music: $t_{(14)} = 8.377$; Attention Control: $t_{(16)} = 5.476$; Silence Condition: $t_{(14)} = 5.556$]. Heart rate levels of the Attention Control group during the experimental period were significantly higher than at baseline [$t_{(16)} = 3.592$], whereas heart rate levels of the Music group were significantly lower than at baseline [$t_{(16)} = 2.239$]. Analyses of systolic blood pressure, diastolic blood pressure, and mean arterial pressure did not reveal any significant effects.

Biochemical Measure Indexing Stress

Salivary Cortisol. Figure 19 presents group mean salivary cortisol levels, which were measured at baseline and during the final stress measurement period. There was a significant difference among groups at baseline [$F(3, 55) = 3.402$, $p < 0.05$]. A post-hoc test revealed that subjects in the Attention Control

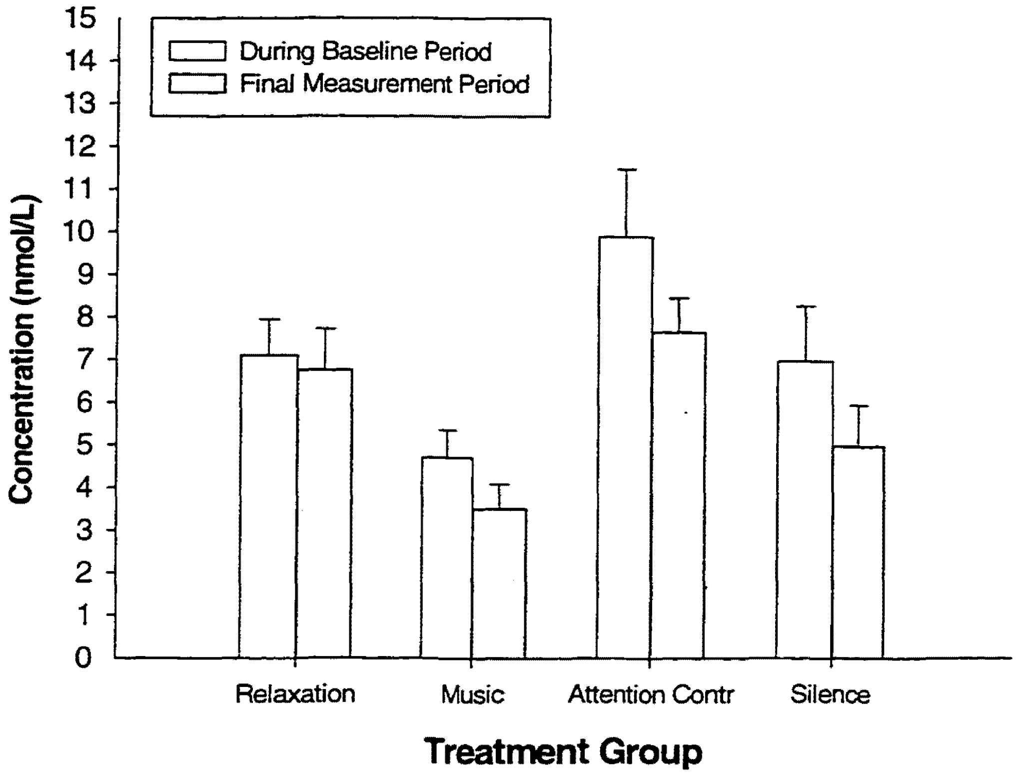

Figure 19. Salivary cortisol responses (nmol/L) obtained during Baseline and Final Measurement periods of the experiment for each experimental group.

group had higher salivary cortisol levels at baseline than subjects in the Music group. Using baseline salivary cortisol levels as a covariate, a significant difference among groups was revealed for mean salivary cortisol levels during the final stress measurement period [$F(3, 51) = 2.980$, $p < 0.05$]. A post-hoc test revealed that subjects in the Music group had lower cortisol levels during the final stress measurement period than subjects in the Progressive Relaxation and

Attention Control groups. Salivary cortisol levels of the Music group [$t_{(12)} = 2.918$] and the Attention Control group [$t_{(15)} = 2.918$] during the final stress measurement period were significantly lower than at baseline.

Psychophysical Measure Indexing Stress

Reactive Irritability Scale (RIS-II). Figure 20 presents group median response levels to auditory stimuli presented by the RIS-II. Table 38 presents chi-square, degrees of freedom, and significance values for analyses of RIS-II data. There was no difference among groups on their median response levels to any of the eight sounds separately. However, comparing the slopes of each group revealed that the Progressive Relaxation group rated the sounds overall as significantly more irritating than the Music group [$t_{(12)} = 2.749$], and the Attention Control group [$t_{(12)} = 2.796$].

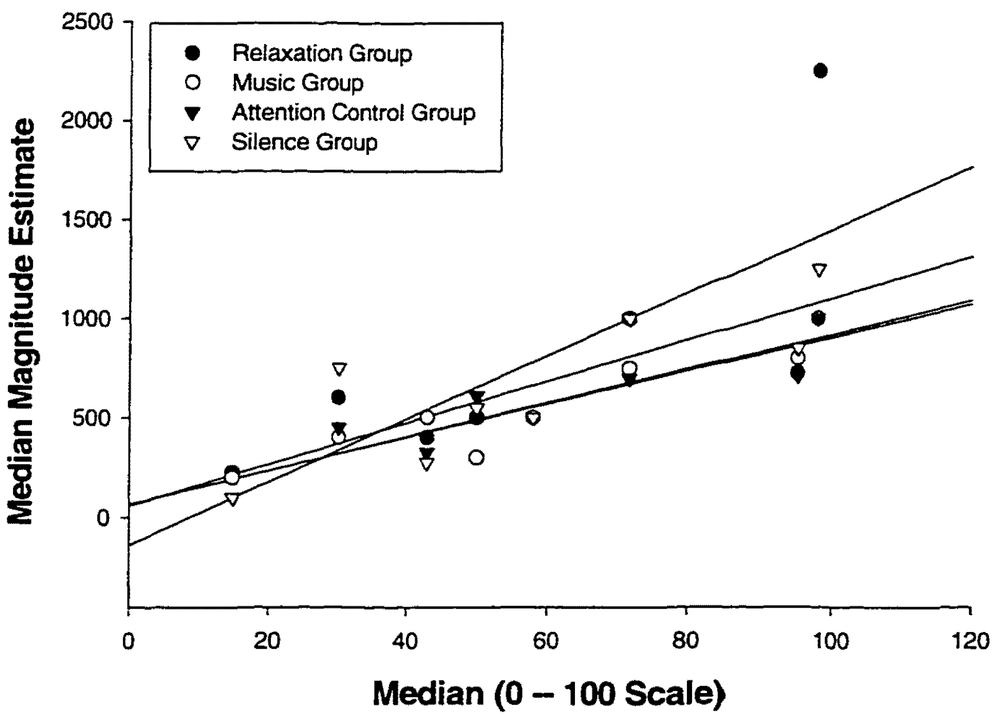

Figure 20. Reactive Irritability Scale (RIS-II) responses obtained during Final Measurement period, plotted as median magnitude estimates versus median ratings from 1 - 100 scale. Slopes of linear functions are: Relaxation Group = 15.89, Music Group = 8.56, Attention Control Group = 8.39, Silence Group = 10.45.

CONFIRMATION OF HYPOTHESES

Hypothesis 1a: The hypothesis that the relaxation conditions (Progressive Relaxation and Music) would result in higher scores on behavioral and self-report measures of **attention** than the control conditions (Attentional Control and Silence) was **partially confirmed.**

Hypothesis 1b: The hypothesis that the Progressive Relaxation condition would result in the highest scores on behavioral and self-report measures of **attention**, followed by subjects in the Music condition, the Attentional Control condition, and the Silence condition was **not confirmed.**

Results: All four groups exhibited similar patterns of performance on the letter cancellation task, and the first, second, and third computer performance tasks. All four groups were significantly faster on a serial addition-subtraction task after the experimental period after controlling for learning and practice effects. In addition, the Music, Attention Control, and Silence conditions all made significantly more errors during the second administration of this task compared to the first administration when comparing the 25 second-half trials.

On self-report measurements, there were no differences among experimental groups on reported levels of attention following the experimental period. However, the music and attention control groups reported themselves to be more distracted following their experimental periods than before that period. For self-focused attention, all four groups reported themselves to be thinking more about the experiment following the stress period, while results from an item

measuring self-focused attention did not vary widely throughout the experiment. In addition, there were no differences among groups on reported levels of external or internal focus throughout the experiment.

Hypothesis 2a: The hypothesis that the relaxation conditions (Progressive Relaxation and Music) would result in the higher scores on behavioral and self-report measures of **relaxation** than the control conditions (Attentional Control and Silence) was **partially confirmed**.

Hypothesis 2b: The hypothesis that the Progressive Relaxation condition would result in the highest scores on behavioral and self-report measures of **relaxation**, followed by the Music condition, followed by the Attentional Control condition, followed by the Silence condition was **partially confirmed**.

Results: On a behavioral measure of relaxation, the Progressive Relaxation group exhibited more relaxation postures than both the Music and the Silence conditions, and the Music group exhibited more relaxation behaviors than did the Silence condition. On self-report measures of relaxation, there was no difference among experimental groups on reported levels of relaxation following the experimental period, however, the Progressive Relaxation group reported being significantly more relaxed when measured at the end of the experimental period compared to the end of the stress manipulation period. Similarly, there was no difference among experimental groups on reported levels of tension after the experimental period, but the Progressive Relaxation group reported being significantly less tense when measured at the end of the experimental period compared to the end of the stress manipulation period.

Hypothesis 3a: The hypothesis that the relaxation conditions (Progressive

Relaxation and Music) conditions would result in the lower self-report, biochemical, and physiological indices of **stress** than the control conditions (Attentional Control and Silence) was **partially confirmed**.

Hypothesis 3b: The hypothesis that the Progressive Relaxation condition would result in the lowest self-report, biochemical, and psychophysiological indices of **stress**, followed by the Music condition, the Attentional Control condition, and the Silence condition was **not confirmed**.

Results: On self-report measures, there were no group differences following the experimental period on reported levels of vigor and levels of fatigue. However, the Music group, the Attention Control group, and Silence Condition group all reported being significantly less vigorous when measured at the end of the experimental period compared to the end of the stress manipulation period. On a biochemical index, subjects in the Music group had lower cortisol levels during the final stress measurement period than did subjects in the Progressive Relaxation and Attention Control groups. On a psychophysiologic measure, all groups had significantly lower heart rates during the experimental period compared to the stress manipulation period, with subjects in the Music group having lower heart rates than subjects in the Attention Control group.

Hypothesis 4a: The hypothesis that the relaxation conditions (Progressive Relaxation and Music) would result in the lower responses on a **psychophysical measurement of stress** than the control conditions (Attentional Control and Silence) was **not confirmed**.

Hypothesis 4b: The hypothesis that the Progressive Relaxation condition would result in the lowest responses on a **psychophysical measurement of**

stress, followed by the Music condition, the Attentional Control condition, and the Silence condition was **not confirmed**.

Results: There was no difference among experimental groups on their ratings to any of the eight sounds separately. However, comparing the overall responses of each group revealed that the Progressive Relaxation group rated the sounds more irritating than the Music and the Attention Control groups.

DISCUSSION

Stress-related conditions are highly prevalent in the United States and exert their effects in terms of lost productivity and increased health care utilization. Stress management interventions have been shown to be effective adjuncts for the management of somatic, behavioral, and psychological disorders. In addition, stress management interventions have been extensively employed in work settings for the prevention and management of occupational stress. However, despite the usefulness of these programs, it is not completely understood how behavioral stress management techniques such as progressive relaxation or autogenic therapy exert their effects. A better understanding of the mechanisms underlying relaxation techniques may prove useful in further refining stress management programs as well as lead to the development of new therapies.

The present study was designed to examine more closely the effects of relaxation using the cognitive-behavioral model of relaxation as a framework. The effects of a Progressive Relaxation condition versus a Music condition versus two different control conditions (Attention Control or Silence) were examined by comparing levels of attention, relaxation, and stress responses that were measured in healthy, male human subjects. These different experimental conditions were selected in order to test whether individual "elements" of relaxation could be separated, whether different stress management techniques had specific effects, or whether different stress management conditions resulted in a generalized reduction of arousal, i.e., a relaxation response.

For purposes of the present experiment, the cognitive behavioral model of relaxation was used as a framework for developing hypotheses. Specifically, in order to test the different models of relaxation, subjects in the Progressive Relaxation condition were exposed to all three elements thought to be essential to the process of relaxation, namely, focusing, passivity, and receptivity (Smith, 1988). The Music condition allowed subjects to take a break from goal-directed activities (passivity), and provided a simple stimulus for them to focus their attention on (focusing), but did not require them to complete a series of unfamiliar exercises. Subjects in the Attention Control condition focused on a taped task (focusing), but were not given a break from goal-directed activities. Finally, subjects in the Silence condition were provided with a break from the experimental stressor (passivity), but were not provided with a tape to focus their attention on, and did not have to tolerate an unfamiliar relaxation experience. Based upon this rationale, specific hypotheses related to the variables to be measured were developed.

It was hypothesized that the Progressive Relaxation and Music conditions would obtain higher scores on behavioral and self-report measures of attention and relaxation, and lower scores on self-report, biochemical, physiological, and psychophysical indices of stress than the two control conditions. In addition, it was hypothesized that the Progressive Relaxation group would achieve the greatest amount of relaxation on these measurements, followed by the Music, Attention Control, and Silence conditions, based upon the number of elements of relaxation that were presumed to be present in their experimental conditions as suggested by the cognitive-behavioral model of relaxation.

Examining the results of behavioral measurements of attention, all four groups exhibited similar patterns of performance on behavioral measures of attention, in contrast to the hypothesized order of outcome. All four groups improved in their times to complete a letter cancellation task following the relaxation or control condition period when compared to the stress condition. In addition, all four groups were faster on the second administration of the computerized mental arithmetic task after controlling for learning and practice effects. According to Kahneman's attention-allocation model (1973), this result suggests that subjects had more attention to allocate to this focus-execute task and, therefore, experienced a decrease in arousal during the relaxation or control condition period. However, the Music group, Attention Control group, and Silence Condition made significantly more errors during the second administration of the serial addition-subtraction task when examining the 25 second-half trials. These results suggest that these three groups did not benefit from their relaxation or control period tasks as the Progressive Relaxation group.

Examining the results of self-report items related to attention, subjects in all groups reported similar amounts of attention on a visual analog measurement at each phase of the experiment. However, only the Music and Attention Control groups reported themselves to be more distracted following their experimental periods than before that period, suggesting that these two groups did not benefit from their relaxation or control period tasks as the other two groups. For self-focused attention, all four groups reported themselves to be thinking more about the experiment following the stress period, while results from an item that was designed to measure self-focused attention did not vary. A similar pattern was

revealed from data obtained from the Focus of Attention Questionnaire, in which all groups reported themselves to be more externally than internally focused during the experiment. These results are not consistent with previous reports of increased self-focused attention following an experimental manipulation that increased arousal (Wegner & Giuliano, 1980; 1983). It is noteworthy, however, that the subjects in those studies were subjected to a physical versus a psychological manipulation to increase arousal, and also were assessed for self-focused attention using a projective measure instead of objective measures such as those used in the present experiment. The different findings from the present experiment may reflect these methodological differences.

Examining results from measurements of relaxation and indices of stress, the Progressive Relaxation condition had the highest scores on a behavioral measure of relaxation, followed by the Music condition and the Silence condition, as hypothesized. In addition, the Progressive Relaxation group reported being significantly more relaxed and less tense at the end of the experimental period compared to the stress period. There were no differences between groups on self-reported levels of stress, in contrast to the hypotheses. However, the Music group, the Attention Control group, and Silence Condition all reported being significantly less vigorous when measured at the end of the experimental period compared to the end of the stress manipulation period. This result again suggests that these groups did not benefit from their relaxation or control period tasks as the Progressive Relaxation group, consistent with results reported above from behavioral and self-report measures of attention.

Examining psychophysiological and biochemical measures of stress,

subjects in all groups had significantly lower heart rates during the experimental period compared to the stress manipulation period. This result suggests that all groups experienced a decrease in arousal, consistent with results from the letter cancellation task presented above. However, in contrast to the hypothesized order, subjects in the Music group appeared to have lower heart rates than did the other groups. Moreover, subjects in the Music group had lower biochemical levels of stress than did those in the Progressive Relaxation and Attention Control groups. On a psychophysical task indexing stress, there were no differences among groups on their ratings of everyday sounds presented by the task, but when overall responses were examined, the Progressive Relaxation group rated the sounds as more irritating than did the Music group and the Attention Control group.

Taken together, the results of the present experiment suggest that different stress management techniques result in a general reduction in arousal, indexed by the reduced heart rate and overall improved cognitive performance of all groups, and consistent with the arousal-reduction model of relaxation. However, in addition, the results of the present experiment suggest that certain stress management techniques may result in specific cognitive, behavioral, and physiological responses that are superimposed upon the reduction in arousal. Specifically, subjects in the Progressive Relaxation condition in this experiment had the highest scores on a behavioral measure of relaxation, followed by the Music condition and the Silence condition. In addition, subjects in the Progressive Relaxation condition committed fewer errors on a behavioral measure of attention following their relaxation task than subjects in other groups.

These results were consistent with findings from self-report data, including: (1) Subjects in the music and attention control groups were more distracted following their experimental periods than before; (2) Subjects in the Music, Attention Control, and Silence Condition were reportedly less vigorous following the experimental period compared to the stress manipulation period; and, (3) Subjects in the Progressive Relaxation were more relaxed and less tense after engaging in their relaxation task.

While these results suggest that the progressive relaxation task was the more powerful stress management technique, as predicted by the cognitive-behavioral model of relaxation, the groups did not follow the ranking predicted by the cognitive-behavioral model in all of the variables measured. Specifically, subjects in the Music group appeared to have lower heart rates than did the other groups following the experimental period. Moreover, subjects in the Music group had lower biochemical levels of stress than did those in the Progressive Relaxation and Attention Control groups. This finding is consistent with previous work (McKinney et al., 1997), and suggests that music alone can result in decreased cortisol responses of patients in Guided Imagery and Music therapy. However, the overall results from the present experiment are more consistent with the compromise position which posits that the specific effects of relaxation techniques may be superimposed upon a general "relaxation response" (Lehrer & Woolfolk, 1993).

The results of the present experiment also suggest that Progressive Relaxation protocols are effective in clinical settings for patients to obtain a relaxed state that they can more easily recognize. By utilizing progressive

relaxation techniques, relaxation therapists can teach patients to exhibit more behaviors that result in relaxation, as opposed to having patients engage in activities that they consider “relaxing,” such as listening to music, or reading. With additional training sessions to reinforce learning to relax, to recognize their relaxed state, and to recognize stress-related events and stimuli, patients can begin to generalize from the clinic to situations outside the clinic that they recognize as stressful, and learn to elicit their relaxed state as needed to help cope with these stress-inducing situations. Therefore, Progressive Relaxation techniques may be most useful for treating patients reporting stress-related symptoms, and who can learn to apply their new relaxation skill when needed to increase feelings of relaxation and reduce symptoms of stress.

The finding that the progressive relaxation technique was the most effective in eliciting relaxation in the present experiment is also consistent with Schachter and Singer's (1962) two-factor theory of emotion. Specifically, revised Jacobsonian progressive relaxation techniques emphasize paying attention to the contrasting tension and relaxation of a condensed sequence of muscle groups while the therapist speaks in a slower, softer, deeper voice when telling patients to relax. Therefore, these revised methods reportedly combine somatic exercises with hypnotic suggestion to *induce* a sense of relaxation during a training session, as opposed to conducting muscular skill training as Jacobson's original method taught (Lehrer, 1982; Lehrer & Woolfolk, 1993). However, in addition to this hypnotic effect, the results of the present experiment suggest that patients using progressive relaxation also experience a reduction in arousal. According to Schachter and Singer's (1962) theory, when people experience a

change in arousal, they search for cognitive cues in order to appropriately label their subsequent emotional state. In their original experiment, the degree to which subjects chose to label their increased arousal according to either happiness or anger cues was reported (Schachter & Singer, 1962). In contrast, subjects in the Progressive Relaxation condition in the present experiment are given relaxation cues by the relaxation tape, which may facilitate them in subsequently labeling their decreased arousal as relaxation. This notion is also consistent with the self-report data gathered in the present experiment, which included: Subjects in the Progressive Relaxation condition were more relaxed and less tense than those in the other conditions following the relaxation or control period; subjects in the music and attention control groups were more distracted following their experimental periods than before; and, subjects in the Music, Attention Control, and Silence Condition were less vigorous following the relaxation or control period. It may be that this process of labeling a decrease in arousal that is experienced by individuals who listen to relaxation tapes is an additional factor that contributes to their reporting themselves as "relaxed," whereas those who engage in other activities are not as apt to make this attribution because other cognitive cues are not present. This possibility also may further explain why some stress management techniques elicit relaxation-induced anxiety. It may be that individuals attempting to use more advanced stress management techniques, such as autogenic training or meditation, are not given salient cognitive cues to label their subsequent decreased arousal, and find this situation anxiety-provoking.

Examining biochemical and physiological responses, subjects in the Music

condition had lower salivary cortisol and lower heart rate responses than other subjects. While these physiological and biochemical effects were not easily discernible as "relaxing" to the subjects in this condition, perhaps because they did not have the appropriate cognitive cues as discussed above, it may be that other stress management strategies, such as listening to music, can result in lower biochemical and physiological stress indices that help listeners to be less vulnerable to stressful events or situations. The results from the present experiment suggest, therefore, that some stress management techniques are useful for the prevention of stress-related conditions. It may be that some activities that people commonly report as "relaxing," such as listening to music, watching television, or reading, are not relaxing *per se*, but result in physiological and biochemical changes that help to prevent the development of stress-related symptoms or conditions. There are a number of potential explanations for these effects. It may be that biochemical and physiological actions that occur during these activities help to restore the body's biological homeostasis that Cannon proposed was part of the process of stress, and thereby reduce the onset of stress-related symptoms and conditions. Alternatively, it may be that listening to music results in the listener having lower baseline levels on these biochemical and physiological indices, and thereby reduce an individual's vulnerability to subsequent stress-related changes in these biological responses.

The possible extensions of the present findings deserve research attention. Future studies could be conducted to investigate whether listening to music can exert these protective effects to people in other stressful situations, such as with commuters driving on the freeway. In addition, other activities such

as watching television should be examined to determine if they exert similar effects, which would help to explain its continued popularity as a relaxing activity. Additional research also could be used to determine whether the present results replicate in groups of women as well as men. Finally, future studies should re-examine the Cognitive-Behavioral model of relaxation. The observed statistical power in analyses of hypotheses that were not confirmed was 0.20. This low power (indicating only a 20% chance of finding an effect that might be present) indicates that the failure to confirm hypotheses related to the Cognitive-Behavioral model of relaxation may have resulted from a sample size that was too small to reveal effects with some of the instruments that were used, rather than a clear rejection of the underlying hypotheses. Calculations of effect size and number of subjects per cell necessary to achieve sufficient power (e.g., 0.80) indicate that approximately 60 subjects per cell are necessary to examine the hypotheses definitively. Future research that examines relaxation to determine whether or not hierarchical effects exist, therefore, will require a larger sample to achieve the power needed to have a reasonable probability of detecting these effects if they exist.

<u>Is Relaxation Distraction or is Distraction Relaxation</u>?

Distraction is another stress management technique that has been documented as helpful for coping with stressors such as dental stress (Anderson, Baron & Logan, 1991), and acute and chronic pain (McCaul & Malott, 1984). In these instances, distraction is broadly defined as directing one's attention away from the sensations or emotional reactions produced by a noxious stimulus in order to minimize the pain experience that may otherwise

result from that experience (McCaul & Mallott, 1984). For example, part of the Lamaze method of childbirth is for a pregnant woman to use a focal point, such as a point on the wall or a light fixture to focus her attention on in order to distract herself from the sensations accompanying labor (Wideman & Singer, 1984). This example makes distraction sound similar to relaxation, as the two stress management methods share the technique of focusing attention on a simple stimulus. But are they the same?

McCaul and Mallott (1984) note that for distraction to achieve a reduction in distress, two implicit assumptions are required. First, for distraction to reduce distress caused by pain, for example, one must assume that pain perception is a controlled rather than an automatic process. In other words, the perception of pain requires the conscious allocation of short-term memory to the task. Second, for a distracting task to be effective, it too must involve controlled, rather than automatic processing. Therefore, the distracting task consumes one's attentional resources, leaving less capacity for controlled processing of the distressing stimulus (McCaul & Mallott, 1984).

Controlled processing is required to focus attention on a simple stimulus in relaxation as in distraction. However, the results of the present experiment suggest that relaxation differs from mere distraction because arousal reduction is necessary for the process of relaxation to occur. In the present experiment, the attention control condition was required to work on another task during the experimental period, analogous to a distraction technique. Their results on cognitive performance tasks following the experimental period were comparable to the other groups. However, results of heart rate data analyses suggested that

the attention control group did not experience the same degree of arousal reduction as subjects in other groups. This finding is consistent with self-report data findings, in which subjects in attention control group reported themselves to be more distracted and less vigorous following the relaxation or control period. In other words, the results of the present experiment suggest that relaxation may be the result of a combination of distraction, i.e., the attention-focusing element, plus arousal reduction. This combination of focusing and arousal reduction may further allow an individual to disengage from goal-directed activity, which may further enhance focusing and arousal reduction, and may further contribute to a sense of relaxation. In contrast, an individual who uses distraction requires continued active, controlled processing to focus on the distracting stimulus in order to reduce distress created by the noxious stimulus.

Critique and Summary

It is noteworthy that there are several limitations of the present study. Specifically, the effects of the stress management strategies utilized in this experiment were examined during the course of only one experimental session with a non-clinical sample. Previous investigations report that maximal relaxation can be attained within the first session, with little training required (Lehrer, 1978; Smith, 1988). The present experiment attempted to capitalize on this effect, and measured only the effects that were obtained during the first session. However, in clinical practice Progressive Relaxation protocols typically are administered over the course of six to twelve sessions (Bernstein & Carlson, 1993). It may be that the effects of relaxation vary between patient and non-patient samples, and over the course of a relaxation training protocol. Therefore, the results of the

present experiment, from data collected from a non-patient sample in one experimental session, would need to be replicated in a patient sample over the course of a stress management program using the same as well as different techniques in order to be generalized to stress management methods. In addition, subjects in this study were only exposed to a mild psychological stressor. The effects of the stress management strategies examined in the present study may be reduced or lost in the presence of a physical stressor or a more intense psychological stressor, and this possibility also merits further investigation.

The present experiment also measured demographic and other characteristics of the experimental sample in order to control for possible differences between experimental groups. However, individual differences also are important variables that may influence the overall effectiveness of particular stress management techniques. Because different people respond differently to relaxation (e.g., Roberts & McGrady, 1996), stress management techniques may be differentially effective among sub-groups of patients who present in the clinical setting. Therefore, future research should attempt to identify the most effective stress management techniques for specific sub-groups (e.g., based upon gender, age, ethnicity, and individual differences in physiological sensitivity to stressors), and determine how to effectively "custom-tailor" stress management interventions to different sub-groups of patients presenting in clinic settings, as well as to their specific presenting complaints. Furthermore, the importance of the patient's acceptance of, and their adherence to alternative therapies have been identified as important factors in their overall effectiveness

(Morin & Wooten, 1996; Lehrer, 1996). Research is also examining the communication process that occurs during psychotherapy to identify "negative process" variables that contribute to the development of poor therapeutic alliance, and ultimately result in the unsuccessful treatment of patients in individual psychotherapy (e.g., Binder & Strupp, 1997). Factors such as patient acceptance and adherence, therapist acceptance, and negative communications between therapist and patient also will influence the effectiveness of stress management interventions, and should be examined in future studies to determine their effects on alternative therapies.

Research on the effects of stress management strategies to reduce or prevent the development of stress-related symptoms or conditions are particularly relevant to military health professionals. Public attention has been directed on the phenomenon of "Gulf War Syndrome," a constellation of signs and symptoms that has struck some veterans since their return from the Persian Gulf War. Some investigators of this condition have proposed that Gulf War Syndrome is a modern definition of a stress-related condition that also was reported by veterans of previous wars, but previously was called shell-shock, combat fatigue, and Post-traumatic Stress Disorder (e.g., Hyams, Wignall, & Roswell, 1996). Research that identifies stress management strategies with preventative effects may help to reduce the development of stress-related symptoms and full-fledged disorders or conditions following future conflicts in which Americans participate.

In conclusion, the present experiment revealed that relaxation techniques involve attending to a simple stimulus and a reduction in arousal, consistent with

previous work. The results were consistent with the position that specific effects of relaxation techniques are superimposed upon a general relaxation response. Progressive relaxation techniques may exert some effects by providing cognitive cues to patients to label their reduced arousal as relaxation. Moreover, relaxing music may be useful for the prevention of stress-related symptoms and conditions. These findings add to the literature regarding relaxation and stress management, and suggest future studies and clinical implications.

TABLES

Table 1. Experimental Design; N = 67.

	Experimental Conditions			
Subjects	Progressive Relaxation n = 17	Music n = 17	Attention Control n = 17	Silence Condition n = 16

Table 2. Experimental Timeline.

Pre-experiment	
Advertisement in the Washington City Paper and Bethesda Gazette	
Telephone Screening	
Assignment to condition, based on age, speech anxiety, and time of day that subject can participate	
Experiment	
Event	Time (min)
Arrival	
Take to experimental suite	5
Introductory monologue and informed consent	5
Baseline Period	
Baseline Saliva Sample Monologue and Collection	3 - 5
Baseline behavioral measures of attention (computer, paper-and-pencil)	8 - 10
Baseline self-report measures (POMS-SF, VAS, PANAS)	5 - 10
Baseline Heart rate (HR) and Blood Pressure (BP) measurement	5
Stress Manipulation Period	
Escort to Speech Preparation Room	1
Stress Condition Monologue	1

Table 2. (Continued)

Speech Preparation Period (HR and BP measures obtained during this period)	15
Letter Cancellation task (Behavioral measure of attention)	3
Self-report measurements (POMS-SF, VAS)	2 - 3
Experimental Period	
Escort to Experimental Condition Room	1
Experimental Condition Monologue	1
Experimental Condition Period, i.e., Progressive Relaxation, Music, Attention Control, or Silence (HR and BP measures obtained during this period)	15
Observe and record behavioral relaxation measurements (Conducted during final 5 minutes of Experimental Period)	5
Behavioral measures of attention (Computer, Paper-and-pencil)	8 - 10
Self-report measurements (POMS-SF, VAS)	2 - 3
Final Stress Measurement Period	
Escort back to Speech Preparation Room	1
Final Stress Measurement Monologue	1
Reactive Irritability Scale Task (RIS-II) (HR and BP measures obtained during this task)	13
Self-report measurements (POMS-SF, VAS)	2
Final Saliva Sample Monologue and Collection	3 - 5
Stop Experiment, Final Self-report measurements (Brief Symptom Inventory, Perceived Stress Scale, Cognitive and Somatic Anxiety Questionnaire, Focus of Attention Questionnaire)	15
Debrief, Thank, and Pay Subject	15

Table 3. Demographics for each experimental group.

	Group Means (± s.d.):			
Demographic Variables:	Progressive Relaxation	Music	Attention Control	Silence
Age	37.9 (±12.2)	34.4 (±10.0)	35.8 (±11.14)	35.44 (±11.95)
Marital Status[1]	1.65 (±.86)	1.82 (±1.07)	1.56 (±.81)	1.50 (±.52)
Education Level[2]	4.12 (±.92)	3.82 (±.88)	3.53 (±.80)	4.06 (±1.06)
Ethnicity[3]	2.82 (±.39)	2.35 (±.61)	2.71 (±.85)	2.62 (±.62)
Personal Income[4]	2.76 (±.97)	2.40 (±.83)	2.25 (±.93)	2.69 (±1.19)
Household Income[5]	3.23 (±.90)	2.85 (±.95)	3.25 (±.77)	3.73 (±.59)

[1] Single = 1; Married = 2; Divorced = 3; Widowed = 4; Separated = 5
[2] High School graduate = 1; Technical School = 2; Some College = 3; College graduate = 4; Graduate work = 5
[3] Asian = 1; African-American = 2; Caucasian = 3; Hispanic = 4; Native American = 5
[4] Less than $10,000 = 1; Between $10,001 and $25,000 = 2; Between $25,001 and $50,000 = 3; Over $50,000 = 4
[5] Less than $10,000 = 1; Between $10,001 and $25,000 = 2; Between $25,001 and $50,000 = 3; Over $50,000 = 4

Table 4a. Results of ANOVA examining between-group differences on age.

Variable	F-value (d.f.)	*p* results
Age	$F(3, 57) = 0.253$	n.s.

Table 4b. Results of Chi-Square analyses examining between-group differences on marital status.

Marital Status:	χ^2 value (d.f.)	Test results
Single	χ^2 (3) = 0.44	n.s.
Married	χ^2 (3) = 3.60	n.s.
Divorced	χ^2 (2) = 0.67	n.s.

Table 4c. Results of Chi-Square analyses examining between-group differences on education level.

Education level:	χ^2 value (d.f.)	Test results
Some college	χ^2 (3) = 4.00	n.s.
College graduate	χ^2 (3) = 2.00	n.s.
Graduate work	χ^2 (3) = 3.57	n.s.

Table 4d. Results of Chi-Square analyses examining between-group differences on ethnicity.

Ethnicity:	χ^2 value (d.f.)	Test results
Asian	χ^2 (2) = 0.00	n.s.
African-American	χ^2 (3) = 3.95	n.s.
Caucasian	χ^2 (3) = 2.38	n.s.

Table 4e. Results of Chi-Square analyses examining between-group differences on personal income.

Personal Income:	χ^2 value (d.f.)	Test results
Less than $10,000	χ^2 (3) = 3.60	n.s.
$10,001 - $25,000	χ^2 (3) = 4.65	n.s.
$25,001 - $50,000	χ^2 (3) = 1.11	n.s.
More than $50,001	χ^2 (3) = 1.11	n.s.

Table 4f. Results of Chi-Square analyses examining between-group differences on household income.

Household Income:	χ^2 value (d.f.)	Test results
\$10,001 - \$25,000	χ^2 (3) = 5.00	n.s.
\$25,001 - \$50,000	χ^2 (3) = 3.31	n.s.
More than \$50,001	χ^2 (3) = 3.24	n.s.

Table 5. Group means for speech anxiety, and results from data analysis.

	Group Means ($\pm$s.d.):			
	Progressive Relaxation	Music	Attention Control	Silence
Speech Anxiety[1]	2.06 ($\pm$.66)	1.94 ($\pm$.90)	1.88 ($\pm$.86)	2.19 ($\pm$.91)
	χ^2 value (d.f.)		Test results	
Low	χ^2 (3) = 2.00		n.s.	
Medium	χ^2 (3) = 5.27		n.s.	
High	χ^2 (3) = 1.52		n.s.	

[1] Low = 1 [Public Speaking subscale of the Personal Report of Communication Apprehension (PRCA) scores between 11 and 19, n = 22]; Medium = 2 (PRCA scores between 20 and 24; n = 22) = 2; High = 3 (PRCA scores between 25 and 40; n = 23)

Table 6. Group means for positive and negative affect, and results from data analyses.

	Group Means ($\pm$s.d.):			
	Progressive Relaxation	Music	Attention Control	Silence
Positive Affect	35.3 ($\pm$6.17)	38.3 ($\pm$5.63)	35.6 ($\pm$8.50)	33.3 ($\pm$6.26)
Negative Affect	18.7 ($\pm$6.78)	15.3 ($\pm$3.20)	14.6 ($\pm$2.50)	18.4 ($\pm$4.96)
	F-Values (d.f.)		*p* Values	
Positive Affect	F(3, 63) = 0.216		n.s.	
Negative Affect	F(3, 63) = 3.352		0.024	

Table 7. Group means for perceived stress, and results from data analysis.

	Group Means (±s.d.):			
	Progressive Relaxation	Music	Attention Control	Silence
Perceived Stress	4.70 (±2.23)	5.35 (±2.57)	4.88 (±2.39)	4.62 (±2.33)
	F-Value (d.f.)		*p* Values	
Perceived Stress	F(3, 63) = 0.313		n.s.	

Table 8. Group means for psychological distress (BSI Total Score), BSI subscales, and results from data analyses.

	Group Means (±s.d.):			
	Progressive Relaxation	Music	Attention Control	Silence
Total Score	21.06 (±15.3)	17.94 (±14.1)	16.12 (±10.1)	24.0 (±13.5)
Anxiety	2.75 (±2.08)	2.06 (±1.34)	1.88 (±1.22)	3.31 (±2.33)
Depression	3.12 (±3.06)	2.12 (±2.68)	2.06 (±1.89)	3.93 (±3.03)
Hostility	1.00 (±1.37)	1.29 (±1.99)	0.76 (±1.25)	1.12 (±1.59)
Psychotic	3.29 (±2.89)	3.81 (±4.20)	2.65 (±2.80)	3.40 (±3.52)
Somatic	1.00 (±1.15)	0.82 (±1.33)	0.94 (±1.52)	1.94 (±1.84)
	F-Values (d.f.)		*p* Values	
Total Score	F(3, 63) = 1.113		n.s.	
Anxiety	F(3, 58) = 1.350		n.s.	
Depression	F(3, 58) = 1.543		n.s.	
Hostility	F(3, 58) = 0.423		n.s.	
Psychotic	F(3, 58) = 0.417		n.s.	
Somatic	F(3, 58) = 1.120		n.s.	

Table 9. Group means for time of day, and results from data analyses.

	Group Means (±s.d.):			
	Progressive Relaxation	Music	Attention Control	Silence
Time of Day[1]	1.88 (±.78)	2.18 (±.72)	2.00 (±.70)	2.19 (±.83)
	χ^2 value (d.f.)		Test results	
Morning	χ^2 (3) = 1.12		n.s.	
Afternoon	χ^2 (3) = 1.21		n.s.	
Evening	χ^2 (3) = 1.27		n.s.	

[1] Morning = 1; Afternoon = 2; Evening = 3

Table 10. Group means for music questionnaire data and results from data analyses.

Music Questionnaire Items	Group Means (±s.d.):	
	Music	Silence
1. How often do you listen to music?[1]	3.37 (±.50)	3.25 (±.58)
2. How often d/y listen to classical music?[1]	1.87 (±.88)	1.56 (±.63)
3. How much do you like music?[2]	3.62 (±.62)	3.37 (±.62)
4. How much do you like classical music?[2]	2.31 (±.95)	1.81 (±..75)
10. What did you think of the music you heard in today's experiment?[3]	2.62 (±.72)	N/A
	F-Values (d.f.)	*p* Values
1. How often do you listen to music?	F(1,30) = 0.429	n.s.
2. How often d/y listen to classical music?	F(1,30) = 1.325	n.s.
3. How much do you like music?	F(1,30) = 1.304	n.s.
4. How much do you like classical music?	F(1,30) = 2.743	n.s.

[1] At least once per hour = 4; per day = 3; per week = 2; per month = 1
[2] Five-point Likert format
[3] Descriptive data coded as: 1 = negative; 2 = neutral; 3 = positive

Table 11. Correlations between musical preference items and other self-report, behavioral, psychophysiological, and biochemical responses obtained in the experiment.

	Correlations				
	MQ1	MQ2	MQ3	MQ4	MQ10
MQ1[1]	1.00	-.188	.054	.018	.232
MQ2[2]	-.188	1.00	-.091	.607*	.236
MQ3[3]	.054	-.091	1.00	-.014	-.037
MQ4[4]	.018	.607*	-.014	1.00	.086
MQ10[5]	.232	.236	-.037	.086	1.00
POMS[6]	-.313	.016	-.482	-.038	.059
VAS[7]	.029	.103	.216	-.145	-.412
URS[8]	-.333	.433	.115	.385	.129
H-R[9]	.280	-.431	.040	-.111	.225
CORT[10]	-.190	.402	-.086	-.060	.234
	Significance level				
	MQ1	MQ2	MQ3	MQ4	Music
MQ1	n.s.	n.s.	n.s.	n.s.	n.s.
MQ2	n.s.	n.s.	n.s.	.013	n.s.
MQ3	n.s.	n.s.	n.s.	n.s.	n.s.
MQ4	n.s.	.013	n.s.	n.s.	n.s.
MQ10	n.s.	n.s.	n.s.	n.s.	n.s.
POMS	n.s.	n.s.	n.s.	n.s.	n.s.
VAS	n.s.	n.s.	n.s.	n.s.	n.s.
URS	n.s.	n.s.	n.s.	n.s.	n.s.
H-R	n.s.	n.s.	n.s.	n.s.	n.s.
CORT	n.s.	n.s.	n.s.	n.s.	n.s.

[1] Music Questionnaire (MQ) item 1; [2] MQ item 2; [3] MQ item 3; [4] MQ item 4; [5] MQ item 10; [6] POMS-SF Tension subscale; [7] VAS item measuring relaxation; [8] Upright Relaxation Scale measurement; [9] Heart-rate measurement; [10] Cortisol post-exp. measurement

Table 12. Group means for letter cancellation task (Digit Vigilance Task).

	Group Means (±s.d.):			
	Progressive Relaxation	Music	Attention Control	Silence
	Time to completion			
During Baseline Period (time in sec.)	2:45 (±00:23)	2:28 (±00:24)	2:45 (±00:20)	2:41 (±00:24)
After Stress Manipulation (sec.)	2:50 (±00:28)	2:31 (±00:25)	2:58 (±00:23)	2:49 (±00:27)
After Experimental Period (sec.)	2:29 (±00:20)	2:18 (±00:22)	2:37 (±00:23)	2:27 (±00:22)
	Total errors			
During Baseline Period (total errors)	3.00 (±4.10)	5.53 (±4.47)	3.06 (±1.91)	3.43 (±3.70)
After Stress Manipulation (errors)	2.75 (±2.59)	4.47 (±3.08)	2.06 (±1.95)	2.69 (±3.11)
After Experimental Period (errors)	3.37 (±4.22)	5.35 (±5.02)	3.29 (±3.67)	2.62 (±2.12)
	Through-put (errors per min.)			
During Baseline Period (errors/min)	1.15 (±1.62)	2.34 (±1.99)	1.11 (±0.69)	1.34 (±1.47)
After Stress Manipulation (e/min)	1.01 (±0.99)	1.84 (±1.23)	0.75 (±0.82)	1.00 (±1.20)
After Experimental Period (errors/min.)	1.37 (±1.79)	2.19 (±2.18)	1.33 (±1.62)	1.06 (±0.87)

Table 13. Results from data analyses examining between-group differences on letter cancellation task (DVT) data.

Time to complete DVT task at each administration		
Administration	F-Values (d.f.)	*p* Values
During Baseline Period	$F(3, 62) = 2.033$	n.s.
After Stress Manipulation	$F(3, 62) = 3.133$	0.032
After Experimental Period	$F(3, 61) = 1.947$	n.s.
Number of errors committed at each administration		
Administration	F-Values (d.f.)	*p* Values
During Baseline Period	$F(3, 62) = 1.789$	n.s.
After Stress Manipulation	$F(3, 62) = 2.445$	n.s.
After Experimental Period	$F(3, 61) = 1.502$	n.s.
Through-put (number of errors per minute)		
Administration	F-Values (d.f.)	*p* Values
During Baseline Period	$F(3, 62) = 2.439$	n.s.
After Stress Manipulation	$F(3, 62) = 3.332$	0.025
After Experimental Period	$F(3, 61) = 1.347$	n.s.

Table 14. Group means for Performance Assessment Battery (PAB) Choice-Reaction Time task.

	Group Means (±s.d.):			
	Progressive Relaxation	Music	Attention Control	Silence
	Time to completion (msec.)			
First 25 trials, Baseline Period	991.00 (±170.13)	1123.42 (±308.79)	1072.25 (±203.74)	1001.71 (±228.39)
Second 25 trials, Baseline Period	837.13 (±145.38)	908.39 (±173.02)	884.61 (±168.84)	852.76 (±148.23)
First 25 trials, Experimental Period	805.43 (±210.17)	898.29 (±180.91)	887.45 (±206.83)	839.75 (±206.13)
Second 25 trials, Experimental Per.	785.78 (±149.07)	849.70 (±152.41)	849.08 (±195.89)	823.03 (±197.68)
	Total errors			
First 25 trials, Baseline Period	1.06 (±1.68)	0.65 (±1.16)	0.29 (±0.59)	0.44 (±0.62)
Second 25 trials, Baseline Period	1.41 (±1.54)	0.65 (±0.78)	0.53 (±1.06)	0.75 (±1.18)
First 25 trials, Experimental Period	1.12 (±3.09)	1.06 (±1.56)	0.47 (±0.72)	0.94 (±1.24)
Second 25 trials, Experimental Per.	1.50 (±3.42)	0.35 (±0.86)	0.47 (±0.62)	0.50 (±0.97)

Table 15. Results from data analyses examining between-group differences on Performance Assessment Battery (PAB) Choice-Reaction Time task.

Time to complete Choice-Reaction task at each administration		
Administration	F-Values (d.f.)	*p* Values
First 25 trials, Baseline Period	F(3,63) = 1.200	n.s.
Second 25 trials, Baseline Period	F(3,63) = 0.678	n.s.
First 25 trials, Experimental Period	F(3,63) = 0.757	n.s.
Second 25 trials, Experimental Per.	F(3,63) = 0.482	n.s.
Number of errors committed at each administration		
Administration	F-Values (d.f.)	*p* Values
First 25 trials, Baseline Period	F(3,63) = 1.873	n.s.
Second 25 trials, Baseline Period	F(3,63) = 1.916	n.s.
First 25 trials, Experimental Period	F(3,63) = 0.425	n.s.
Second 25 trials, Experimental Per.	F(3,63) = 0.259	n.s.

Table 16. Group means for Performance Assessment Battery (PAB) Serial Addition-Subtraction task.

	Group Means (±s.d.):			
	Progressive Relaxation	Music	Attention Control	Silence
	Time to completion (msec.)			
First 25 trials, Baseline Period	1734.75 (±1041.06)	2290.98 (±1676.48)	2469.18 (±1844.20)	1821.38 (±753.15)
Second 25 trials, Baseline Period	837.13 (±145.38)	908.38 (±173.02)	884.61 (±168.84)	852.76 (±148.23)
First 25 trials, Experimental Period	1148.54 (±472.17)	1418.23 (±634.56)	1356.87 (±632.91)	1097.58 (±239.98)
Second 25 trials, Experimental Per.	1066.85 (±290.73)	1118.50 (±438.92)	1155.68 (±405.19)	1049.27 (±250.83)
	Total errors			
First 25 trials, Baseline Period	4.23 (±3.33)	4.76 (±2.25)	6.18 (±3.78)	4.00 (±3.94)
Second 25 trials, Baseline Period	1.41 (±1.54)	0.65 (±0.78)	0.53 (±1.07)	0.75 (±1.18)
First 25 trials, Experimental Period	3.33 (±4.89)	3.81 (±4.00)	4.41 (±4.34)	3.00 (±3.92)
Second 25 trials, Experimental Per.	2.53 (±2.92)	3.60 (±3.64)	5.12 (±5.14)	2.75 (±3.25)

Table 17. Results from data analyses examining between-group differences on Performance Assessment Battery (PAB) Serial Addition-Subtraction task.

Time to complete Choice-Reaction task at each administration		
Administration	F-Values (d.f.)	*p* Values
First 25 trials, Baseline Period	F(3,63) = 1.078	n.s.
Second 25 trials, Baseline Period	F(3,63) = 0.678	n.s.
First 25 trials, Experimental Period	F(3,58) = 0.894	n.s.
Second 25 trials, Experimental Per.	F(3,58) = 0.297	n.s.
Number of errors committed at each administration		
Administration	F-Values (d.f.)	*p* Values
First 25 trials, Baseline Period	F(3,63) = 1.396	n.s.
Second 25 trials, Baseline Period	F(3,63) = 1.916	n.s.
First 25 trials, Experimental Period	F(3,58) = 0.318	n.s.
Second 25 trials, Experimental Per.	F(3,58) = 1.470	n.s.

Table 18. Group means for Performance Assessment Battery (PAB) Six-Letter Search task.

	Group Means (±s.d.):			
	Progressive Relaxation	Music	Attention Control	Silence
	Time to completion			
During Baseline Period	9004.86 (±2850.22)	8227.67 (±2494.46)	6892.61 (±2588.49)	7970.55 (±2071.79)
After Experimental Period	9281.47 (±2084.19)	8130.97 (±2157.24)	7723.69 (±2317.35)	7920.47 (±1962.24)
	Total errors			
During Baseline Period	1.43 (±2.14)	1.47 (±1.95)	2.07 (±1.49)	1.44 (±1.46)
After Experimental Period	2.00 (±0.72)	0.80 (±0.94)	1.37 (±1.09)	1.00 (±0.96)

Table 19. Results from data analyses examining between-group differences on Performance Assessment Battery (PAB) Six-Letter Search task.

Time to complete Choice-Reaction task at each administration		
Administration	F-Values (d.f.)	*p* Values
During Baseline Period	$F(3,55) = 1.707$	n.s.
After Experimental Period	$F(3,57) = 1.685$	n.s.
Number of errors committed at each administration		
Administration	F-Values (d.f.)	*p* Values
During Baseline Period	$F(3,55) = 1.707$	n.s.
After Experimental Period	$F(3,57) = 1.886$	n.s.

Table 20. Group means for a self-report measure (VAS) of attention during the experiment.

	Group Means (±s.d.):			
	Progressive Relaxation	Music	Attention Control	Silence
During Baseline Period	2.25 (±1.76)	2.60 (±1.82)	2.52 (±1.55)	2.59 (±1.73)
After Stressor Period	2.41 (±1.37)	1.85 (±1.16)	2.43 (±1.69)	2.53 (±1.66)
After Experimental Period	2.56 (±1.36)	2.32 (±1.36)	3.77 (±1.97)	2.81 (±1.97)
During Final Period	3.33 (±1.83)	2.55 (±1.66)	3.84 (±2.03)	3.30 (±2.06)

Table 21. Results from data analyses examining between-group differences on a self-report measure (VAS) of attention during the experiment.

VAS Item: Extremely Focused — Extremely Distracted		
Administration	F-Values (d.f.)	*p* Values
During Baseline Period	$F(3,63) = 0.152$	n.s.
After Stressor Period	$F(3,63) = 0.722$	n.s.
After Experimental Period	$F(3,63) = 2.410$	n.s.
During Final Period	$F(3,63) = 1.340$	n.s.

Table 22. Group means for a self-report measure (VAS) of external attention during the experiment.

	Group Means (±s.d.):			
	Progressive Relaxation	Music	Attention Control	Silence
During Baseline Period	6.97 (±3.23)	5.85 (±2.93)	4.63 (±3.12)	7.49 (±2.69)
After Stressor Period	5.43 (±3.64)	4.22 (±2.84)	2.71 (±2.72)	5.01 (±3.01)
After Experimental Period	5.39 (±3.68)	5.39 (±2.83)	3.16 (±2.36)	5.77 (±3.08)
During Final Period	4.29 (±3.29)	4.99 (±2.79)	3.43 (±2.98)	4.35 (±2.91)

Table 23. Results from data analyses examining between-group differences on a self-report measure (VAS) of external attention during the experiment.

VAS Item: I'm thinking a lot about — not at all about the next task.		
Administration	F-Values (d.f.)	*p* Values
During Baseline Period	F(3,63) = 2.971	0.038
After Stressor Period	F(3,63) = 2.575	n.s.
After Experimental Period	F(3,63) = 2.607	n.s.
During Final Period	F(3,63) = 0.773	n.s.

Table 24. Group means for a self-report measure (VAS) of internal attention during the experiment.

	Group Means (±s.d.):			
	Progressive Relaxation	Music	Attention Control	Silence
During Baseline Period	4.96 (±3.33)	4.95 (±2.64)	2.84 (±2.14)	4.84 (±3.08)
After Stressor Period	5.39 (±3.49)	4.32 (±2.82)	2.97 (±2.51)	6.08 (±2.82)
After Experimental Period	5.39 (±3.14)	4.71 (±2.54)	3.19 (±2.81)	5.57 (±2.76)
During Final Period	5.54 (±2.90)	5.22 (±2.77)	4.18 (±2.93)	5.91 (±2.81)

Table 25. Results from data analyses examining between-group differences on a self-report measure (VAS) of internal (e.g., self-focused) attention during the experiment.

VAS Item: I'm thinking a lot about — not at all about how I'm doing.		
Administration	F-Values (d.f.)	*p* Values
During Baseline Period	F(3,63) = 2.282	n.s.
After Stressor Period	F(3,63) = 3.551	0.019
After Experimental Period	F(3,63) = 2.465	n.s.
During Final Period	F(3,63) = 1.145	n.s.

Table 26. Group means for Focus of Attention (FAQ) subscales, and results from data analysis.

	Group Means (±s.d.):			
	Progressive Relaxation	Music	Attention Control	Silence
Internal Subscale	5.65 (±4.30)	4.88 (±3.18)	6.18 (±3.61)	5.31 (±3.11)
External Subscale	8.71 (±3.82)	7.41 (±3.10)	9.41 (±4.06)	8.25 (±2.82)
	F-Values (d.f.)		*p* Values	
Internal Subscale	$F(3, 63) = 0.393$		n.s.	
External Subscale	$F(3, 63) = 0.975$		n.s.	

Table 27. Group means for a self-report measure (VAS) of relaxation during the experiment.

	Group Means (±s.d.):			
	Progressive Relaxation	Music	Attention Control	Silence
During Baseline Period	5.94 (±2.19)	6.51 (±1.84)	6.67 (±2.34)	6.32 (±1.89)
After Stressor Period	5.76 (±2.24)	6.69 (±2.52)	6.22 (±2.28)	6.46 (±2.16)
After Experimental Period	6.90 (±2.01)	6.47 (±2.51)	6.09 (±2.42)	6.82 (±1.92)
During Final Period	6.67 (±2.09)	6.98 (±2.08)	6.58 (±1.79)	6.59 (±1.72)

Table 28. Results from data analyses examining between-group differences on a self-report measure (VAS) of relaxation during the experiment.

VAS Item: Very Tense -- Very Relaxed.		
Administration	F-Values (d.f.)	*p* Values
During Baseline Period	F(3,63) = 0.388	n.s.
After Stressor Period	F(3,63) = 0.497	n.s.
After Experimental Period	F(3,63) = 0.473	n.s.
During Final Period	F(3,63) = 0.153	n.s.

Table 29. Group means for a self-report measure (POMS-SF) of tension during the experiment.

	Group Means (±s.d.):			
	Progressive Relaxation	Music	Attention Control	Silence
During Baseline Period	3.82 (±3.08)	3.06 (±2.16)	2.41 (±1.94)	3.20 (±2.48)
After Stressor Period	4.17 (±1.98)	2.35 (±1.69)	2.12 (±2.18)	3.25 (±2.46)
After Experimental Period	3.23 (±2.61)	2.06 (±1.78)	2.65 (±2.91)	2.44 (±1.79)
During Final Period	2.71 (±2.28)	2.06 (±1.85)	1.82 (±1.94)	3.00 (±2.53)

Table 30. Results from data analyses examining between-group differences on a self-report measure (POMS-SF) of tension during the experiment.

POMS-SF Tension Subscale.		
Administration	F-Values (d.f.)	*p* Values
During Baseline Period	F(3,62) = 0.945	n.s.
After Stressor Period	F(3,63) = 3.421	0.022
After Experimental Period	F(3,63) = 0.751	n.s.
During Final Period	F(3,63) = 1.066	n.s.

Table 31. Group means for a self-report measure (POMS-SF) of vigor during the experiment.

	Group Means (±s.d.):			
	Progressive Relaxation	Music	Attention Control	Silence
During Baseline Period	10.06 (±4.20)	12.58 (±5.28)	9.59 (±5.86)	8.87 (±3.65)
After Stressor Period	9.00 (±4.87)	12.47 (±5.87)	8.59 (±6.49)	8.25 (±3.34)
After Experimental Period	7.59 (±5.51)	10.70 (±5.79)	7.06 (±6.73)	5.87 (±3.44)
During Final Period	7.18 (±5.29)	9.82 (±5.56)	6.82 (±5.92)	5.00 (±2.99)

Table 32. Results from data analyses examining between-group differences on a self-report measure (POMS-SF) of vigor during the experiment.

POMS-SF Vigor Subscale.		
Administration	F-Values (d.f.)	*p* Values
During Baseline Period	$F(3,62) = 1.862$	n.s.
After Stressor Period	$F(3,63) = 2.283$	n.s.
After Experimental Period	$F(3,63) = 2.320$	n.s.
During Final Period	$F(3,63) = 2.524$	n.s.

Table 33. Group means for a self-report measure (POMS-SF) of fatigue during the experiment.

	Group Means (±s.d.):			
	Progressive Relaxation	Music	Attention Control	Silence
During Baseline Period	2.53 (±2.55)	1.71 (±1.90)	1.76 (±2.97)	2.56 (±3.50)
After Stressor Period	2.65 (±2.40)	1.81 (±1.90)	2.47 (±3.47)	2.33 (±2.74)
After Experimental Period	2.88 (±2.17)	2.29 (±1.96)	3.23 (±3.90)	3.00 (±2.73)
During Final Period	2.94 (±2.70)	2.52 (±1.94)	2.76 (±3.49)	3.18 (±3.08)

Table 34. Results from data analyses examining between-group differences on a self-report measure (POMS-SF) of fatigue during the experiment.

POMS-SF Fatigue Subscale.		
Administration	F-Values (d.f.)	*p* Values
During Baseline Period	$F(3,62) = 0.476$	n.s.
After Stressor Period	$F(3,61) = 0.290$	n.s.
After Experimental Period	$F(3,63) = 0.348$	n.s.
During Final Period	$F(3,63) = 0.156$	n.s.

Table 35. Group means for Cognitive and Somatic Anxiety (CSAQ) subscales, and results from data analyses.

	Group Means (±s.d.):			
	Progressive Relaxation	Music	Attention Control	Silence
Cognitive Subscale	6.65 (±4.87)	3.29 (±3.08)	3.18 (±2.50)	5.56 (±5.11)
Somatic Subscale	5.29 (±4.30)	3.23 (±2.63)	3.88 (±2.91)	4.69 (±4.09)
	F-Values (d.f.)		*p* Values	
Cognitive Subscale	F(3, 63) = 3.062		0.034	
Somatic Subscale	F(3, 63) = 1.095		n.s.	

Table 36. Group means for measurements of heart rate (bpm) during the experiment.

	Group Means (±s.d.):			
	Progressive Relaxation	Music	Attention Control	Silence
During Baseline Period	69.50 (±10.40)	65.35 (±9.87)	69.29 (±9.35)	67.00 (±9.11)
During Stressor Period	77.57 (±11.47)	71.67 (±8.85)	76.26 (±8.27)	75.83 (±11.40)
During Experimental Period	70.09 (±9.99)	63.47 (±7.70)	72.88 (±7.87)	66.97 (±9.00)
During Final Period	67.82 (±10.22)	63.35 (±7.38)	68.20 (±8.61)	65.44 (±8.00)

Table 37. Results from data analyses examining between-group differences on measurements of heart rate (bpm) during the experiment.

Heart Rate (BPM).		
Measurement	F-Values (d.f.)	*p* Values
During Baseline Period	$F(3,63) = 0.705$	n.s.
After Stressor Period	$F(3,61) = 1.044$	n.s.
After Experimental Period	$F(3,62) = 3.574$	0.019
During Final Period	$F(3,60) = 1.136$	n.s.

Table 38. Chi-square, degrees of freedom, and significance data from analyses of Reactive Irritability Scale (RIS-II) data.

Reactive Irritability Scale (RIS-II).		
Environmental Sound Stimulus	Chi-square Values (d.f.)	*p* Values
Diving	$X^2(3) = 0.981$	n.s.
Telephone	$X^2(3) = 3.709$	n.s.
Trotting	$X^2(3) = 5.410$	n.s.
Bugle	$X^2(3) = 2.238$	n.s.
Bowling	$X^2(3) = 4.860$	n.s.
Barking	$X^2(3) = 2.062$	n.s.
Siren	$X^2(3) = 0.916$	n.s.
Fire Engine	$X^2(3) = 0.272$	n.s.

APPENDIX I

Instrumentation

STRESS, SMOKING, AND RELAXATION
TELEPHONE SCREENING

NAME:____________________________ AGE:__________ B/T 18-55?YN (N = DQ)

ADDRESS:_________________________ MARITAL STATUS: (S) (M) (D) (W) (Sep)

____

TELEPHONE: (H)____________________ (W)__________________________

Subject prefers to be contacted at: (H) or (W)

1. Are you a U.S. Citizen? Y N (N = DQ)

2. What is the highest educational level you have attained?

___ Elementary School	___ AB Degree	Education Level
___ Junior High School	___ BA or BS Degree	HS/GED Diploma
___ HS Diploma	___ Graduate Work	or above?
___ Tech School	___ Ph.D.	
___ Some College		Y N (N = DQ)

3. Are you active duty military? Y* N
   *If yes, inform no payment is possible and subject must use TDY to participate

4. How would you describe yourself in terms of ethnicity?

Asian	African-American	Caucasian
Hispanic	Native American	Other (specify):________________

5. What is your primary language? ____________________ English? Y N (N = DQ)

6. Have you ever been diagnosed with any of the following health problems?

___ Diabetes	___ Flashbacks/PTSD	Any health Y N
___ Heart Disease	___ Panic Attacks	Problems? (Y = DQ)
___ High/Low Blood Pressure	___ Schizophrenia	
___ Anxiety/Depression	___ Substance Abuse	
___ Others/Comments____________________________________		

____

7. Are you currently taking any medications, including over-the-counter medications?
Y N
(Y = DQ)

If so, what are they? ____

8. Have you ever been diagnosed with a learning or reading disorder? Y N
(Y = DQ)

9. Have you ever been diagnosed with a speech or attentional disorder? Y N
(Y = DQ)

10. Have you ever been diagnosed with a visual or hearing disorder? Y N
(Y = DQ)

11. Do you have any writing or speech problems? Y N
(Y = DQ)

12. Do you have any physical disabilities? Y N

(If yes) What kind?____

13. Do you smoke cigarettes, cigars, or use other tobacco products? Y N
(***Must be Y for Smoking Subjects)

(If yes) How long have you currently been smoking
or using tobacco?____________(***Must be at least 2 years for Smoking Subjects)

(If yes) What kind (including brand)?________________________________

(If cigarettes) How many cigarettes do you smoke
each day?__________________ (***Must be at least 15 for Smoking Subjects)

(If cigarettes) How soon after you wake up
do you smoke a cigarette?_________________ (***w/in 5; 6 - 30; 31-60; or >60
minutes)

14. Do you drink more than 5 beverages a day which contain caffeine,
such as coffee, coke, or pepsi? Y N
(Y = DQ)

15. Have you ever participated as a subject in a research project at the Uniformed Services University of the Health Sciences? Y N

(If yes) Was this study conducted by the Department of Medical Psychology? Y N

(If yes) Did you participate in a study at USUHS within the last six months? Y N (Y = DQ)

(If yes) Did this study involve listening to noise? Y N (Y = DQ)

(If yes) Did this study involve preparing a speech? Y N (Y = DQ)

16. (OPTIONAL) How would you describe your personal annual income for 1997? Would it be:

___ Under $5,000	___ Between 20,001 to $30,000
___ Between $5,001 to $10,000	___ Between 30,001 to $40,000
___ Between $10,001 to $15,000	___ Between $40,001 to $50,000
___ Between $15,001 to $20,000	___ Over $50,000

17. (OPTIONAL) How would you describe your household annual income for 1997? Would it be:

___ Under $5,000	___ Between 20,001 to $30,000
___ Between $5,001 to $10,000	___ Between 30,001 to $40,000
___ Between $10,001 to $15,000	___ Between $40,001 to $50,000
___ Between $15,001 to $20,000	___ Over $50,000

PRCA

Please answer the next 10 questions on a scale of 1 to 5, using the following statements to guide your answers: 1 indicates that you strongly agree with the statement; 2 means that you agree somewhat with the statement; 3 means you are undecided; 4 means you disagree somewhat with the statement, and 5 means you disagree strongly with the statement.

						SCORE:
1. I have no fear of facing an audience (R).	1	2	3	4	5	___
2. I look forward to an opportunity to speak in public (R).	1	2	3	4	5	___

3. Although I talk fluently with friends, I am at a loss for words in front of an audience.	1	2	3	4	5	___
4. My hands tremble when I try to handle objects in front of an audience.	1	2	3	4	5	___
5. I always avoid speaking in public if possible.	1	2	3	4	5	___
6. I feel that I am more fluent when talking to people than most other people are (R).	1	2	3	4	5	___
7. My thoughts become confused and jumbled when speaking before an audience.	1	2	3	4	5	___
8. Although I am nervous just before getting up to speak, I soon forget my fears and enjoy the experience (R).	1	2	3	4	5	___
9. I face the prospect of giving a speech with complete confidence (R).	1	2	3	4	5	___
10. I would enjoy presenting a speech on a local television show (R).	1	2	3	4	5	___

PRCA SCORE TOTAL:________

SUBJECT'S AGE: ____________

REJECTED **ACCEPTED**

Reason for rejection is: Assigned to Group:

Additional
Comments:____

Interviewer:__________________ Date:__________________

NAME:______________________________ DATE:____________________

Below are words that describe feelings and moods people have. Please read EVERY word carefully. Select the answer which best describes how you feel AT THIS MOMENT by placing a check or X in the appropriate box.

FEELING/MOOD	Not at all	A little bit	Moderately	Quite a bit	Extremely
1. Worn-out					
2. Angry					
3. Tense					
4. Confused					
5. Lively					
6. Sad					
7. Fatigued					
8. Peeved					
9. On edge					
10. Unable to concentrate					
11. Active					
12. Blue					
13. Exhausted					
14. Grouchy					
15. Uneasy					
16. Bewildered					
17. Energetic					
18. Hopeless					
19. Weary					
20. Annoyed					
21. Restless					
22. Forgetful					
23. Cheerful					
24. Discouraged					
25. Bushed					
26. Resentful					
27. Nervous					
28. Uncertain about things					
29. Full of pep					
30. Miserable					
31. Bitter					
32. Anxious					
33. Vigorous					
34. Helpless					
35. Furious					
36. Worthless					
37. Unhappy					

PANAS

This scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you general feel this way, that is, how you feel on the average. Use the following scale to record your answers.

1	2	3	4	5
very slightly or not at all	a little	moderately	quite a bit	extremely

______ interested	______ irritable
______ distressed	______ alert
______ excited	______ ashamed
______ upset	______ inspired
______ strong	______ nervous
______ guilty	______ determined
______ scared	______ attentive
______ hostile	______ jittery
______ enthusiastic	______ active
______ proud	______ afraid

PSS

DIRECTIONS: Please describe how much the following problems or complaints have bothered you *during the past month* by placing a check or X in the box that most accurately describes your situation.

1. In the last month, how often have you felt you were unable to control the important things in your life?

☐ never
☐ almost never
☐ sometimes
☐ fairly often
☐ very often

2. In the last month, how often have you felt confident about your ability to handle your personal problems?

☐ never
☐ almost never
☐ sometimes
☐ fairly often
☐ very often

3. In the last month, how often have you felt that things were going your way?

☐ never
☐ almost never
☐ sometimes
☐ fairly often
☐ very often

4. In the last month, how often have you felt that difficulties were piling up so high that you could not overcome them?

☐ never
☐ almost never
☐ sometimes
☐ fairly often
☐ very often

VAS

DIRECTIONS: Place an 'X' or a mark at the point on the following five lines to best describe yourself AT THIS MOMENT:

1.

Very Tense	______________________________	Very Relaxed

2.

Extremely Focused	______________________________	Extremely Distracted

3.

I would love to smoke a cigarette right now.	______________________________	I would hate to smoke a cigarette right now.

4.

I'm thinking a lot about the next task	______________________________	I'm not thinking at all about the next task.

5.

I'm thinking a lot about how I'm doing	______________________________	I'm not thinking at all about how I'm doing.

INSTRUCTIONS: Below is a list of problems and complaints that people sometimes have. Please read each one carefully. After you have done so, please fill in one of the spaces to the right with a check that best describes HOW MUCH THAT PROBLEM HAS BOTHERED YOU DURING THE PAST TWO WEEKS, INCLUDING TODAY. Make only one check mark for each item.

How much were you bothered by:	Not at all	A little bit	Moderately	Quite a bit	Extremely
1. Nervousness or shakiness inside.					
2. Faintness or dizziness.					
3. The idea that someone else can control your thoughts.					
4. Feeling others are to blame for most of your troubles.					
5. Trouble remembering things.					
6. Feeling easily annoyed or irritated.					
7. Pains in heart or chest.					
8. Feeling afraid in open spaces.					
9. Thoughts of ending your life.					
10. Feeling that most people cannot be trusted.					
11. Suddenly scared for no reason.					
12. Temper outbursts that you could not control.					
13. Feeling lonely even when you are with people.					
14. Feeling lonely.					
15. Feeling blocked in getting things done.					
16. Feeling blue.					
17. Feeling no interest in things.					
18. Feeling fearful.					

How much were you bothered by:	Not at all	A little bit	Moderately	Quite a bit	Extremely
19. Your feelings being easily hurt.					
20. Feeling like people are unfriendly or dislike you.					
21. Feeling inferior to others.					
22. Nausea or upset stomach.					
23. Feeling that you are watched or talked about by others.					
24. Having to check and double-check what you do.					
25. Difficulty making decisions.					
26. Feeling afraid to travel on buses, subways, or trains.					
27. Trouble getting your breath.					
28. Hot or cold spells.					
29. Avoiding certain things, places, or activities because they frighten you.					
30. Your mind going blank.					
31. Numbness or tingling in parts of your body.					
32. The idea that you should be punished for your sins.					
33. Feeling hopeless about the future.					
34. Trouble concentrating.					
35. Feeling weak in parts of your body.					
36. Feeling tense or keyed up.					
37. Having urges to beat, injure, or harm someone.					
38. Having urges to break or smash things.					

How much were you bothered by:	Not at all	A little bit	Moderately	Quite a bit	Extremely
39. Feeling very self-conscious with others.					
40. Feeling uneasy in crowds.					
41. Never feeling close to another person.					
42. Spells of terror or panic.					
43. Getting into frequent arguments.					
44. Feeling nervous when you are alone.					
45. Others not giving you proper credit for your achievements.					
46. Feeling so restless you couldn't sit still.					
47. Feelings of worthlessness.					
48. Feeling that people will take advantage of you if you let them.					
49. The idea that something is wrong with your mind.					

*Adapted from Derogatis & Melisaratos (1983).

MQ

DIRECTIONS: Answer the following questions by placing a check or X in the box that most accurately describes your situation.

1. How often do you listen to music (e.g., live, radio, CD)?

   - ☐ At least once per hour
   - ☐ At least once per day
   - ☐ At least once per week
   - ☐ At least once per month

2. How often do you listen to classical music (e.g., live, radio, CD)?

   - ☐ At least once per hour
   - ☐ At least once per day
   - ☐ At least once per week
   - ☐ At least once per month

3. How much do you like music?

   - ☐ Not at all
   - ☐ A little bit
   - ☐ Moderately
   - ☐ Quite a bit
   - ☐ Extremely

4. How much do you like classical music?

   - ☐ Not at all
   - ☐ A little bit
   - ☐ Moderately
   - ☐ Quite a bit
   - ☐ Extremely

5. How much knowledge or experience do you have of music?

   - ☐ None
   - ☐ A little bit
   - ☐ A fair amount
   - ☐ Quite a bit
   - ☐ A lot

6. How much knowledge or experience do you have of classical music?

    - ☐ None
    - ☐ A little bit
    - ☐ A fair amount
    - ☐ Quite a bit
    - ☐ A lot

7. Please describe what kind of music you prefer to listen to:

____

____

____

8. Please describe when you most often listen to music:

____

____

____

9. Please describe what you were thinking about while you listened to the music today:

____

____

____

10. Please describe what you thought of the music that you heard today:

____

____

____

CSAQ

DIRECTIONS: Rate the degree to which you generally or typically experience the following symptoms when you are feeling anxious by placing a check or X in the appropriate box.

Symptoms	Not at all	A little bit	Moderately	Quite a bit	Extremely
I find it difficult to concentrate because of uncontrollable thoughts.					
I worry too much over something that doesn't really matter.					
I imagine terrifying scenes.					
I can't keep anxiety provoking pictures out of my mind.					
Some unimportant thought runs through my mind and bothers me.					
I feel like I am losing out on things because I can't make my mind up soon enough.					
I can't keep anxiety provoking thoughts out of my mind.					
My heart beats faster.					
I feel jittery in my body.					
I get diarrhea.					
I feel tense in my stomach.					
I nervously pace.					
I become immobilized.					
I perspire.					

APPENDIX II

Informed Consent Form

INFORMED CONSENT FORM
FOR A RESEARCH STUDY
ON EFFECTIVE COMMUNICATION

INTRODUCTION

You are being asked to take part in a research study. Before you decide to be a part of this research study, you need to understand the risks and benefits so that you can make an informed decision. This is known as informed consent.

This consent form provides information about the research study which has been explained to you. Once you understand the study and the tasks it requires, you will be asked to sign this form if you want to take part in the study. Your decision to take part in the study is voluntary. This means you are free to choose if you will take part in the study.

DESCRIPTION OF PURPOSE AND PROCEDURES

The Department of Medical and Clinical Psychology of the Uniformed Services University of the Health Sciences is carrying out a research study on effective communication. We are interested in this topic to better understand how some people better communicate than others, which will help us to be better instructors. Another reason is that we train medical students at this school, and they need to learn how to effectively communicate with patients. This study consists of filling out some questionnaires, completing some computer and paper and pencil tasks, and completing some tape-recorded exercises. We will be making observations throughout the experiment. We will measure your heart rate and blood pressure at various times during the study, and also will ask you to give a saliva sample. You may be videotaped during part of the study. If so, you will be told in advance when you will be videotaped. If you are videotaped, no one other than individuals involved in conducting the study will have access to the tape. Your participation in this study will require approximately three hours. You will receive $30.00 for participation in the study. Approximately 100 people will be asked to take part in the study. A complete explanation of the research will be provided to you after the completion of the study. Any questions you have can be addressed at the end of today's session.

POSSIBLE BENEFITS

Other than the financial compensation, you will not receive any benefits from this study. Your active participation for the entire three hour period is required to receive the $30.00 payment.

Subject's Initials:_______________

Date:_______________

Witness Initials:_______________

Date:_______________

POSSIBLE RISKS

There are no risks likely to result from your participation in this study.

ALTERNATIVES AND COSTS

As this study does not involve receiving treatment, there are no alternative treatments that are necessary, nor are there any additional costs that you are required to pay in order to take part.

RIGHT TO WITHDRAW FROM THE STUDY

If you decide to take part in this study, you are free to withdraw your consent and to discontinue at any time. However, if you choose to discontinue before the end of the three-hour period, you will not receive financial payment for taking part. Your decision whether or not to participate will not prejudice your future contacts with the Uniformed Services University of the Health Sciences or its affiliates.

PAYMENT FOR HARM OR INJURY

The Department of Defense will provide medical care for DoD eligible members (active duty, dependents, and retired military) for physical illness resulting from participation in this research. Such care may not be available to other research participants, except in the event of an emergency. Compensation may be available through judicial avenues to non-active duty research participants if they are injured.

PRIVACY

All information that you provide as part of this study will be confidential and will be protected to the fullest extent of the law. In having oversight for all human subject research at USUHS, the Institutional Review Board may review information related to your taking part in this study. Except for these people, information that you provide and other records related to this study will be kept private, accessible only by those persons directly involved with conducting the study. All questionnaires and forms will be kept in a restricted access, locked cabinet while not in use. Military members who decide to participate should be advised that under UCMJ, their confidentiality cannot be strictly guaranteed. Any reports on this study will not use your name or identify you personally.

Subject's Initials:______________

Date:______________

Witness Initials:______________

Date:______________

QUESTIONS

If you have any questions about this research study, you should call the principal investigator, Dr. Neil Grunberg at (301) 295-9673. If you have any questions about your rights as a research subject, you should call the Director of Research Programs, in the Office of Research at the Uniformed Services University of the Health Sciences at (301) 295-3303. This person is your representative and has no connection to the personnel conducting the study.

SIGNATURES

By signing this consent form you are agreeing that this study has been explained to you and that you understand the study. You are signing that you agree to take part in this study. You will be given a copy of this consent form.

DATE:____________________

NAME OF VOLUNTEER:____________________________________

SIGNATURE OF VOLUNTEER:____________________________________

DATE:____________________

SIGNATURE OF WITNESS:____________________________________

INVESTIGATOR STATEMENT

I certify that the research study has been explained to the above individual, by me or my research staff, and that the individual understands the nature and purpose, the possible risks and benefits associated with taking part in this research study. Any questions that have been raised, have been answered.

SIGNATURE OF CO-INVESTIGATOR:____________________________________

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